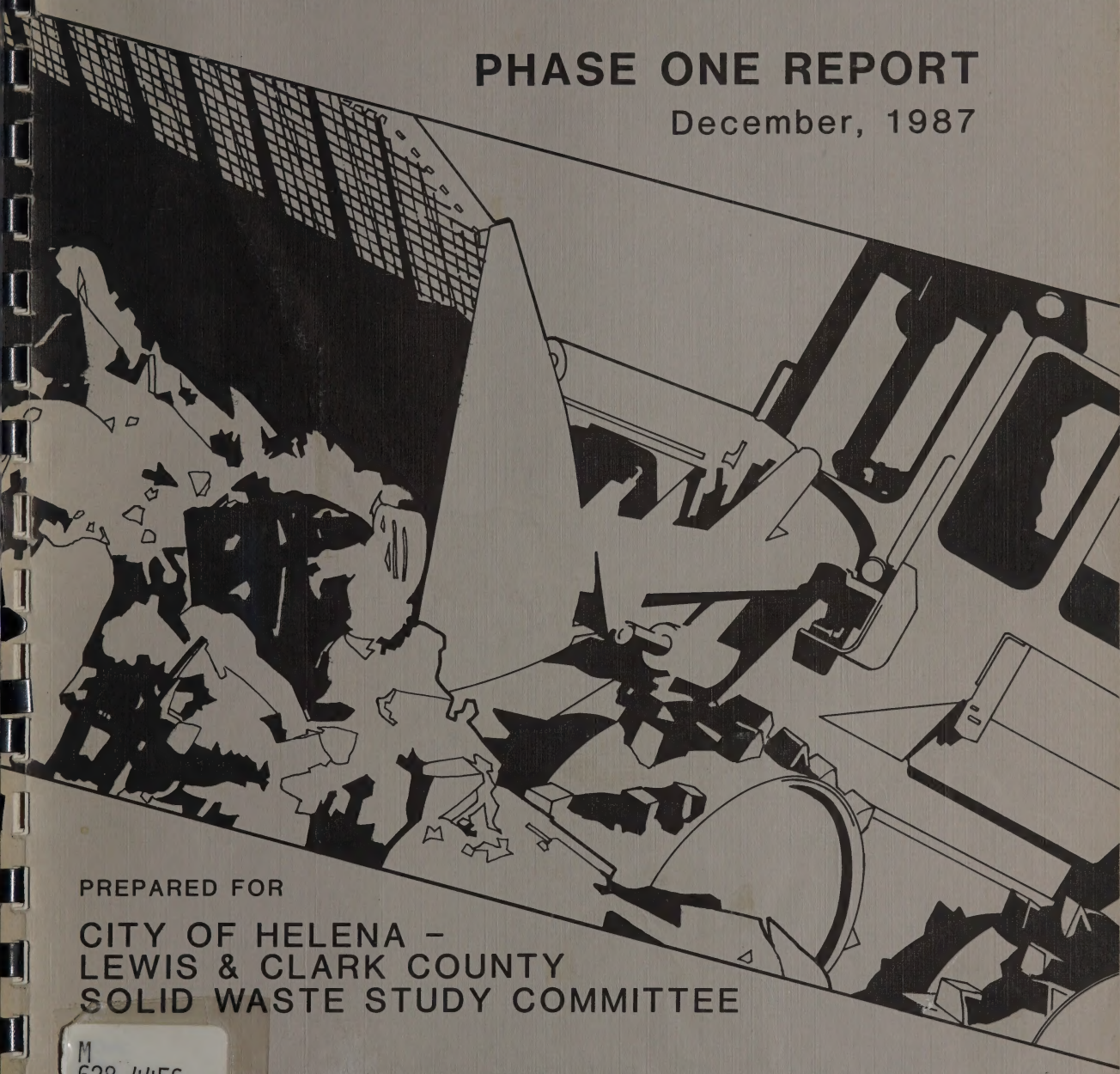
SANITARY LANDFILL SITING STUDY

PHASE ONE REPORT

December, 1987



PREPARED FOR

CITY OF HELENA –
LEWIS & CLARK COUNTY
SOLID WASTE STUDY COMMITTEE

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Damschen & Associates
Helena, Montana

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Damschen
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December 21, 1987

City-County Solid Waste Study Committee
c/O City of Helena
316 North Park
Helena, MT 59623

Re: Sanitary Landfill Siting Study

Dear Committee Members:

We are pleased to submit this Phase One Report concerning the location of a new sanitary landfill to serve the southern portion of Lewis & Clark County. As a result of the efforts conducted by Damschen & Associates, Northern Engineering and Testing and the study committee members, we have identified five (5) candidate areas that have excellent potential for siting a new landfill.

We look forward to your review of this report as well as the continued efforts that will be conducted in Phase Two of the project. If you have any questions or comments, please contact me at your earliest convenience.

Sincerely,

DAMSCHEN & ASSOCIATES

Barry E. Damschen, P.E.
Project Manager

Enclosure

SANITARY LANDFILL SITING STUDY

FOR

CITY-COUNTY SOLID WASTE STUDY COMMITTEE

(HELENA AND LEWIS AND CLARK COUNTY, MONTANA)

PHASE ONE REPORT

December, 1987

Submitted by:

DAMSCHEN & ASSOCIATES
Helena, Montana

In Association With

NORTHERN ENGINEERING & TESTING
Helena, Montana

Lewis & Clark Library
120 S. Last Chance Mall
Helena, Montana 59601

ACKNOWLEDGEMENT

The consulting firms of Damschen & Associates and Northern Engineering & Testing would like to thank the members of the City-County Solid Waste Study Committee for their input, review and assistance during the First Phase of the landfill site selection process. Without this assistance the project would not have been a success. The current members of the study committee are listed herein.

NAME	JURISDICTION
Rick Brasch	City Resident
Dave Hunter	County Resident
Tom Rippendale	Scratchgravel Sanitary Landfill District
Rick Duncan	City-County Health Department
Kathy Macefield	City Planning Department
Robert Rasmussen	County Planning Department
Ted Hill	City Public Works Department
Tom Rasmussen	Local Legislator
Rose Leavitt	City Commissioner
Dave Fuller	County Commissioner
James Leiter	State Solid & Hazardous Waste Bureau
Robert Davis	U.S.G.S.
Larry Moore	Mayor of East Helena

ACKNOWLEDGEMENT

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PART ONE

INTRODUCTION

PART ONE

INTRODUCTION

I. EXISTING WASTE DISPOSAL CONDITIONS

A. Disposal Facilities

In southern Lewis & Clark County there are two primary sanitary landfills that accept and dispose of solid waste. One site is operated by the City of Helena and is located within the City limits on land leased from the Burlington Northern Railroad. In addition to the wastes generated in the City, wastes from East Helena, Fort Harrison, private contractors and individuals from outside the City are accepted for a fee.

The second primary landfill in the area is operated under the jurisdiction of the Scratchgravel Sanitary Landfill District. The District encompasses the majority of the unincorporated areas of extreme southern Lewis & Clark County. All members of the District are entitled to use the District's sanitary landfill located approximately three miles north of Helena near Green Meadow Drive.

In addition to these two sanitary landfills, the City of East Helena operates a Class III disposal site. This site is located one-half mile west of East Helena and is limited to only Group III wastes which includes demolition and construction debris, trees and other inert materials. This landfill is limited in use to the residents and businesses located in East Helena. The majority of the waste generated in East Helena including all putrescible wastes are transported to the City of Helena's landfill using the City of East Helena's packer truck.

B. Waste Quantities

To identify the quantity of wastes currently being handled in the area, the City of Helena, City of East Helena and Scratchgravel Landfill District officials were contacted. Based on conversations with and data provided by each jurisdiction, the following waste quantities were identified:

1. City of Helena Landfill

The City of Helena landfill is one of very few disposal sites in Montana where all wastes that are deposited at the site are initially weighed and recorded. The weight receipt records for the past several years were provided by the City to the consultant. As a result of this data it was determined that approximately 30,000 tons of waste are deposited

annually at the landfill. A breakdown of the waste brought to the landfill in 1986 is as follows:

City of Helena Landfill Quantities

Transportation Mode	Approximate Number of Loads	Approximate Annual Tonnage
Packer Trucks	4,700	19,500
Others	29,000	10,500
Total	33,700	30,000

2. Scratchgravel Landfill

The officials of the Scratchgravel District indicated that no vehicles that enter the landfill are weighed. The attendants do, however, keep records of the number of packer trucks that use the site but no day to day records of the number of other types of vehicles are kept. Based on the records available and through subsequent conversations with the landfill supervisor, it was estimated that approximately 10,000 tons of waste are deposited at the Scratchgravel landfill annually. An estimated breakdown of this waste is indicated below:

Scratchgravel Landfill
Estimated Waste Quantities

Transportation Mode	Approximate Number of Loads	Approximate Annual Tonnage
Packer Trucks	700	3,000
Other	35,000	7,000
Total	35,700	10,000

3. City of East Helena

As previously indicated, the City of East Helena transports the majority of the wastes generated in East Helena to the Helena landfill (approximately 1,400 tons annually). The remaining Group III type wastes that are deposited at the East Helena Class III site are estimated to represent only a few hundred tons per year. An accurate account of this waste is not recorded.

II. FORMATION OF STUDY COMMITTEE

In 1985 the local officials in the City of Helena and Lewis & Clark County determined the need to investigate long range solutions to solid waste disposal in the southern portion of Lewis & Clark County. This was in light of the fact that both the Scratchgravel and City of Helena landfills are reaching their useful life. Estimates indicate that both sites will become fully utilized in approximately five years.

To study the solid waste disposal alternatives in the area, the City-County Solid Waste Study Committee was formed through a joint resolution by the City of Helena Commission and Lewis & Clark Board of County Commissioners. The two entities then appointed members to serve on the study committee. The current study committee members are listed in the preface of this report.

Initially the study committee updated a 1981 solid waste resource recovery study. This update concluded that a resource recovery waste to energy facility is not economically feasible in the Helena area at this time. Based on this, the study committee determined that the efforts should focus on locating a new landfill site.

III. SCOPE OF SERVICES

In May 1986 the committee issued a Request for Proposals to qualified consultants to conduct a detailed landfill siting study. After review of several proposals the committee retained Damschen & Associates to conduct the study. The study was initiated in February, 1987 with a public meeting to present the scope of work and procedures that would be followed for locating a new landfill site.

The scope of work for this project is divided into two phases. The initial phase focused on a preliminary screening analysis whereby unsuitable areas were eliminated due to hydrogeologic and land use considerations. The work in Phase One culminated with the selection of five areas that meet all preliminary screening criteria and correspondingly warrant additional investigations and analysis. This report summarizes the analysis that was conducted for this initial phase.

Upon review and approval of the work contained in this Phase One Report, by the study committee, the consultant will proceed with Phase Two of the landfill siting analysis. The second phase work will include a detailed investigation and cost analysis of the five areas that were selected in Phase One. As a result of this work, recommendations will be formulated concerning the most preferred landfill site(s).

The initial task that was conducted by the study committee and consultant was to identify the limits of the area in which the location study would focus. After review and discussion by the committee, an area that basically encompasses a 20 mile radius of

Helena was selected. The approximate boundaries of the study area are Winston to the southeast, the Missouri River to the northeast, the Gates of the Mountains to the north, Canyon Creek to the northwest, the Helena National Forest boundary to the west and Clancy and the Helena National Forest boundary to the south. The location of this area is depicted on Figure 1.

Figure 1

EA LOCATION MAP

STUDY AREA BOUNDARY

COUNTY BOUNDARY

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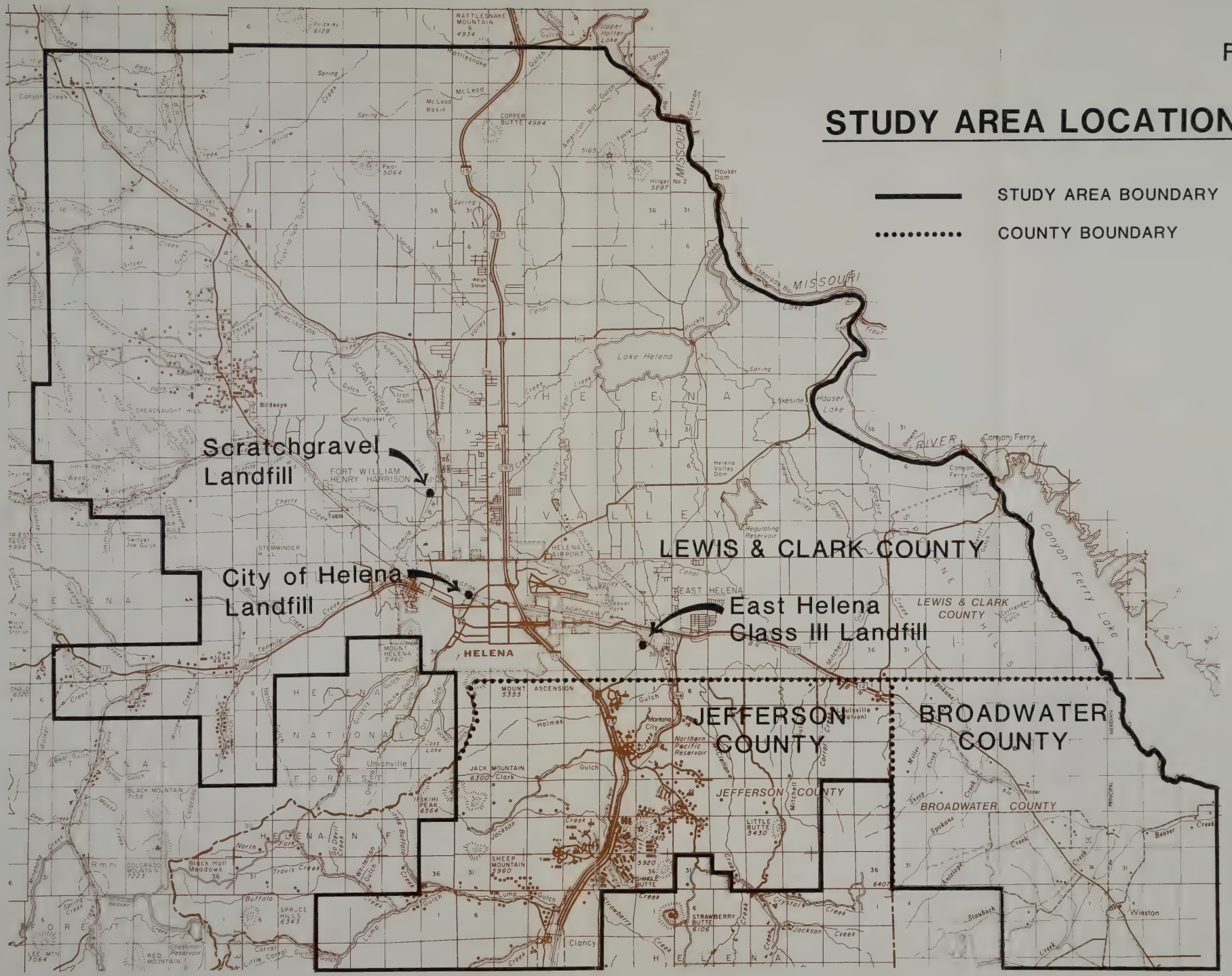
Figure 1

STUDY AREA LOCATION MAP



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PART TWO

INITIAL SCREENING ANALYSIS

PART TWO

INITIAL SCREENING ANALYSIS

I. GENERAL

Initially in the project, the study committee and the consultant formulated procedures which the landfill analysis and selection would follow. The initial step that was developed involves the screening or elimination of areas that are not suitable for landfilling wastes. The primary objective of this screening process was to reduce the large land area within the study area boundary to a manageable number of candidate areas that have a higher probability of containing suitable landfill sites.

II. DEVELOPMENT OF CRITERIA

Initially for this process the consultant developed a list of criteria that are applicable for evaluating potential landfill sites. The criteria were developed to meet the following objectives:

* protecting public health and environmental values;
* satisfying regulatory requirements;
* compatibility with community values and socio-economic impacts; and
* minimizing site development costs and transportation distances.

The consultant's list included nine hydrogeologic related criteria, four surface water related criteria, sixteen socio-economic related criteria and seven additional criteria that generally relate to or could possibly affect the environment. These criteria are summarized on Table 1.

The thirty seven various criteria were then submitted to the study committee for review. Based on this review, seven specific criteria were then determined to be quite significant and thus were identified as "Mandatory Criteria". The committee and consultant agreed that any particular parcel of land that does not meet any one or more of the seven Mandatory Criteria would be eliminated from further consideration. The seven Mandatory Criteria and minimum requirements for each are summarized on Table 2.

TABLE 1

LANDFILL LOCATION STUDY SITING CRITERIA

I. Hydrogeology & Geology
- Depth to Water
- Depth to Bedrock
- Slope
- Surficial Materials (Type & Depth)
- Permeability of Base
- Aquifer Media
- Ground Water Use & Quality
- Distance to Domestic Wells
- Seismic Risk Zones

II. Surface Waters
- Flood Plains
- Wetlands
- Public Surface Water Supply Watershed
- Distance to Major Spring, Irrigation Ditch, Lake, etc.
- Above Site Drainage Considerations

III. Socio-Economic Considerations
- Proximity to Airport
- Current Land Use & Zoning
- Land Use Potential
- Proximity to Population Density (Aesthetic Factor)
- Proximity to Population Density (Convenience Factor)
- Distance from Major Roadways
- Size of Parcel
- Utilities
- Transportation Network
- Land Ownership & Availability
- Scenic Values
- Jurisdictional Constraints
- Site Development Costs
- Site Operational Costs
- Transportation Costs
- Total System Costs

IV. Other Environmental Considerations
- Climatology
- Air
- Noise
- Vegetation
- Wildlife
- Cultural & Historical
- Threatened Species

TABLE 2

MANDATORY SCREENING CRITERIA

CRITERIA	MINIMUM REQUIREMENTS
Hydrogeologic & Physical Considerations	
Floodplains	Areas not within the floodplain of any stream or river
Depth to Groundwater	Areas with groundwater not less than 12 ft. to surface
Wetlands	Areas not within any designated wetland area
Public Water Supply Watershed	Areas not within the direct watershed of any public surface water supply impoundment
Depth to Bedrock	Areas with bedrock not less than 8 ft. to surface
Land Use Considerations	
Current Land Use	Areas not within platted or residentially or commercially zoned areas, parks, designated recreation areas or highway R.O.W.
Proximity to Airport	Areas not closer than 10,000 ft. to airport runway

III. RESULTS OF SCREENING PROCESS

The next step in the site selection process was to obtain available information concerning the seven Mandatory Criteria. Once all available information was assembled and reviewed the study area was screened to eliminate the areas that do not meet one or more of the Mandatory Criteria. The unsuitable areas with regard to the five hydrogeologic and physical criteria were screened first. Once those areas were eliminated, the remaining area was screened for the two mandatory land use criteria. The areas that were eliminated as a result of the screening process are depicted on Figure 2. As indicated on the Figure, approximately two-thirds of the land area was eliminated from further consideration as a result of this process.

The basic information that was developed for each of the seven criteria are summarized below.

A. Flood Plains

All area within the 100 year flood plain of any stream or river in the study area was eliminated from consideration for potential landfill sites. Information on the extent of the 100 year flood plain was obtained primarily from the Flood Boundary and Floodway Maps of Lewis and Clark County, Montana (Federal Emergency Management Agency, 1985). Additional information was obtained from the Southeast Helena Hazard Mitigation Plan (Jim E. Richard Consulting Services and others, 1986), and Wilke and Johnson (1977). In several headwater areas not covered by these maps, the 100 year flood plain was estimated using the drainage area of streams, aerial extent of alluvial stream deposits on geologic maps, and topographic cross-sections of the streams.

B. Depth to Ground Water

A depth to ground water of 12 feet or less was used to define areas in which high ground water would preclude placement of a landfill. The value of 12 feet was selected as a minimum depth of ground water which would be needed to conduct landfill operations. Information on ground water depths was obtained from numerous published and unpublished sources. Published sources include: Schmidt, 1986; Moreland and Leonard, 1980; Wilke and Coffin, 1973; and Lorenz and Swenson, 1951. Unpublished sources of ground water information include Layne Minnesota Company (1971) report to the City of Helena, and numerous well logs from the Montana Department of Natural Resources and Conservation.

C. Wetlands

The Montana Department of Fish, Wildlife and Parks was contacted to determine if any designated wetlands existed in the study area. Montana does not have a wetland classification for land, however, several Wildlife Management Areas are designated. No Wildlife Management areas are located within the study area. Other areas known to be waterfowl nesting sites, such as the area around Lake

Figure 2

CREENING ANALYSIS

AREAS ELIMINATED DUE TO HYDROGEOLOGIC & PHYSICAL CONSIDERATIONS

AREAS ELIMINATED DUE TO LAND USE CONSIDERATIONS

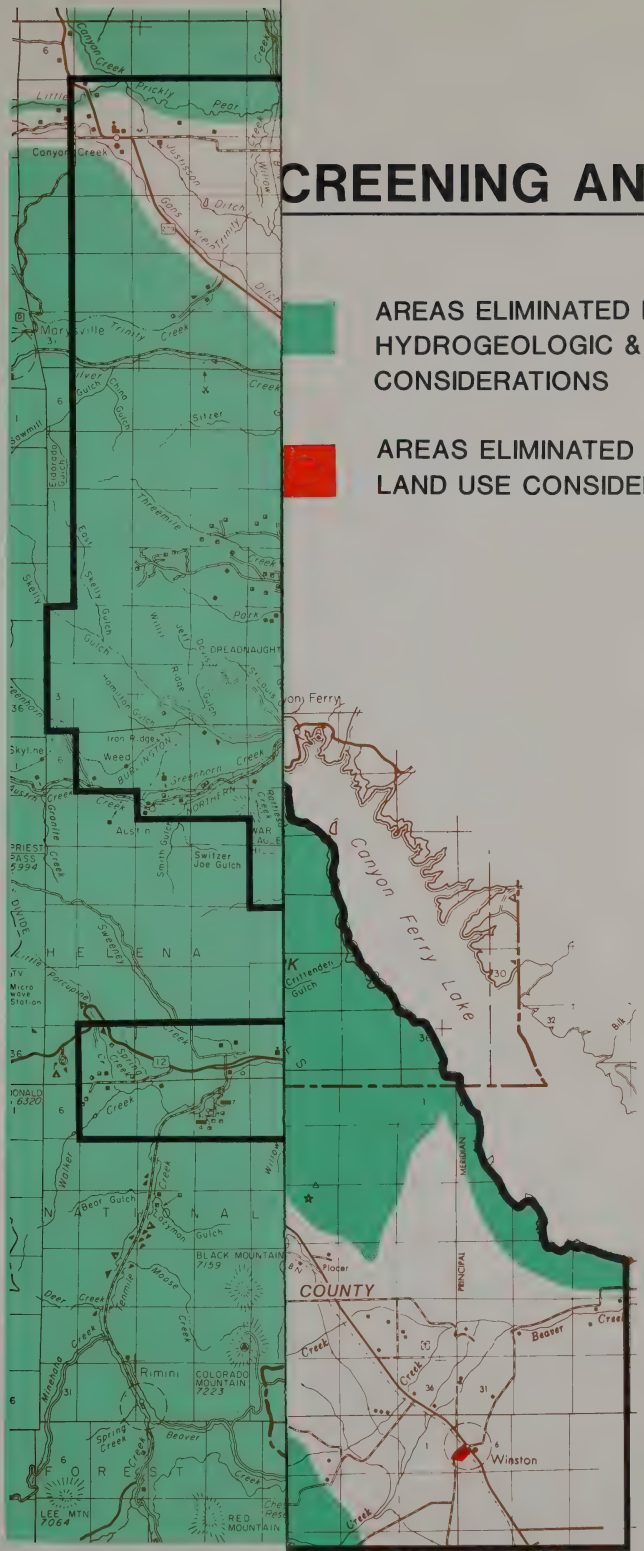

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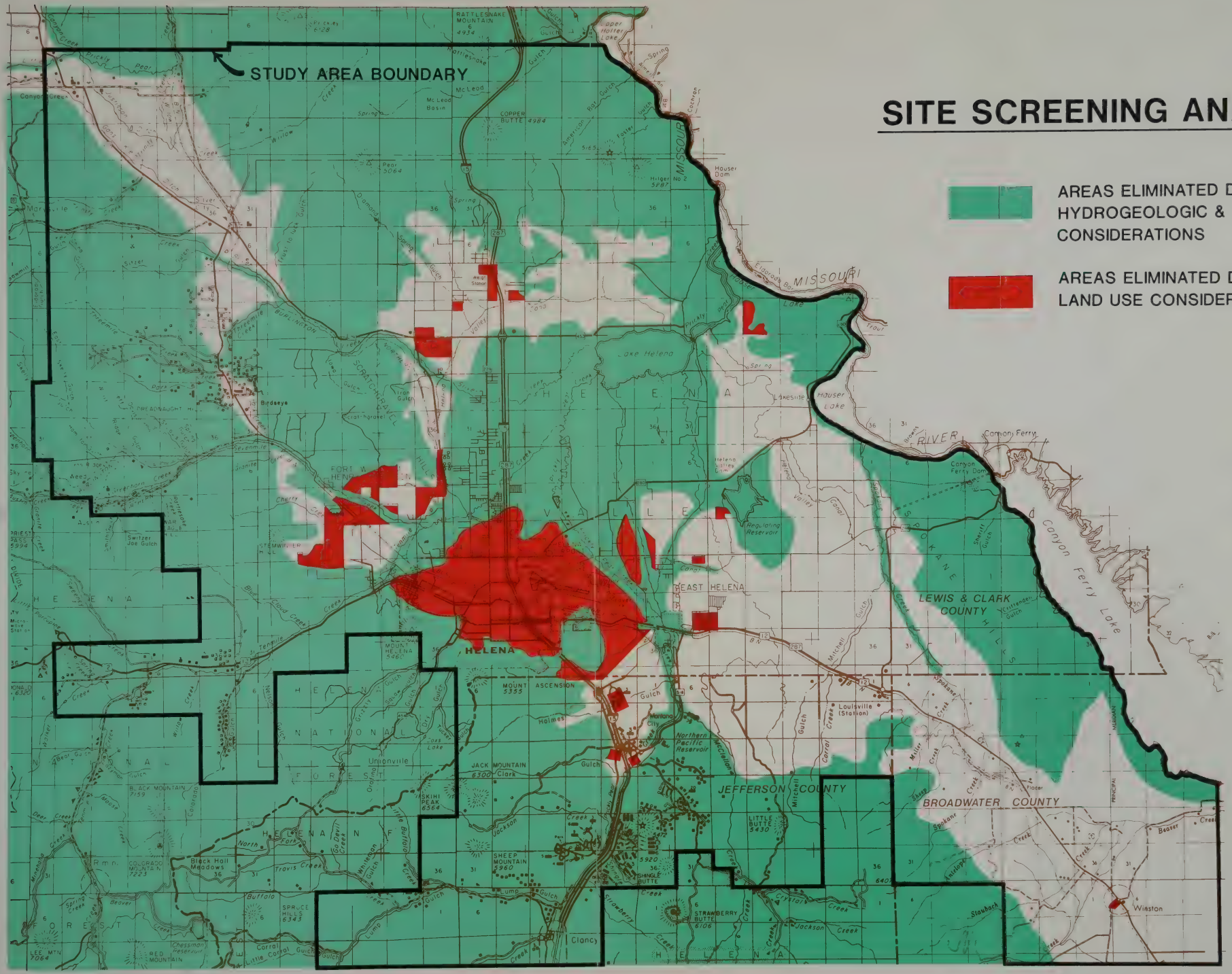
Figure 2

SITE SCREENING ANALYSIS



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Helena, were already excluded from further study by the depth to ground water criteria.

D. Public Water Supply

Two areas within the study area are within the watershed of a public water supply. One area is the small drainage basin above the Helena Valley Regulatory Reservoir used for Helena's water supply. The second area is the McClellan Creek drainage basin, including Lost, Jackson, and Crystal Creeks. Both of these drainages were eliminated from consideration as potential landfill locations.

E. Depth to Bedrock

A depth to bedrock of eight feet was considered the minimum thickness of soil or alluvium required to operate an efficient landfill. Areas with exposed bedrock or with bedrock estimated to be less than eight feet below the surface were eliminated from consideration. Information on bedrock depth was obtained from; Knopf (1913), Knopf (1963), Stickney and Bingler (1981), Schmidt (1986), Stickney (in preparation), Ross (1963), Olsen and others (1977), and Pardee (1925).

F. Current Land Use

Areas that were eliminated due to current land use considerations included the following: Areas located within the City of Helena and City of East Helena corporate limits, areas outside the City limit boundaries that are platted for residential or commercial development, areas that are zoned for residential or commercial use and areas that are designated for parklands or recreation uses. Although not specifically outlined on Figure 2, areas that are located on Federal, State or County highway right-of-ways were also eliminated from further consideration. Information concerning the location of these platted, zoned and special use areas was obtained from the Lewis and Clark County, Jefferson County and Broadwater County planning boards.

G. Proximity to Airport

According to Federal Aviation Administration (FAA) requirements, sanitary landfills cannot be located closer than 10,000 linear feet from any active airport runway. If this requirement is not met, the local jurisdictional entity responsible for the airport is not eligible to obtain FAA construction grants to upgrade their airport. The only airport in the study area that is affected by this requirement is the City of Helena Airport located between Helena and East Helena. Any areas that are located within 10,000 feet from the runway at the airport were eliminated from further consideration.

PART THREE

EVALUATION OF CANDIDATE SITES

PART THREE

EVALUATION OF CANDIDATE AREAS

I. SELECTION OF AREAS

Upon completion of the site screening for the mandatory criteria, the next major task was to select candidate areas for more detailed analysis and ranking. Initially for this task the consultant conducted a windshield survey of the remaining areas within the study area that had not been eliminated during the mandatory screening process. During this survey 16 areas were identified as being potentially suitable for locating a regional landfill site. The primary criteria that were considered during this process included: distance from Helena, proximity to major highways, proximity to major development and subdivisions, potential visual impacts, current land use and hydrogeologic considerations.

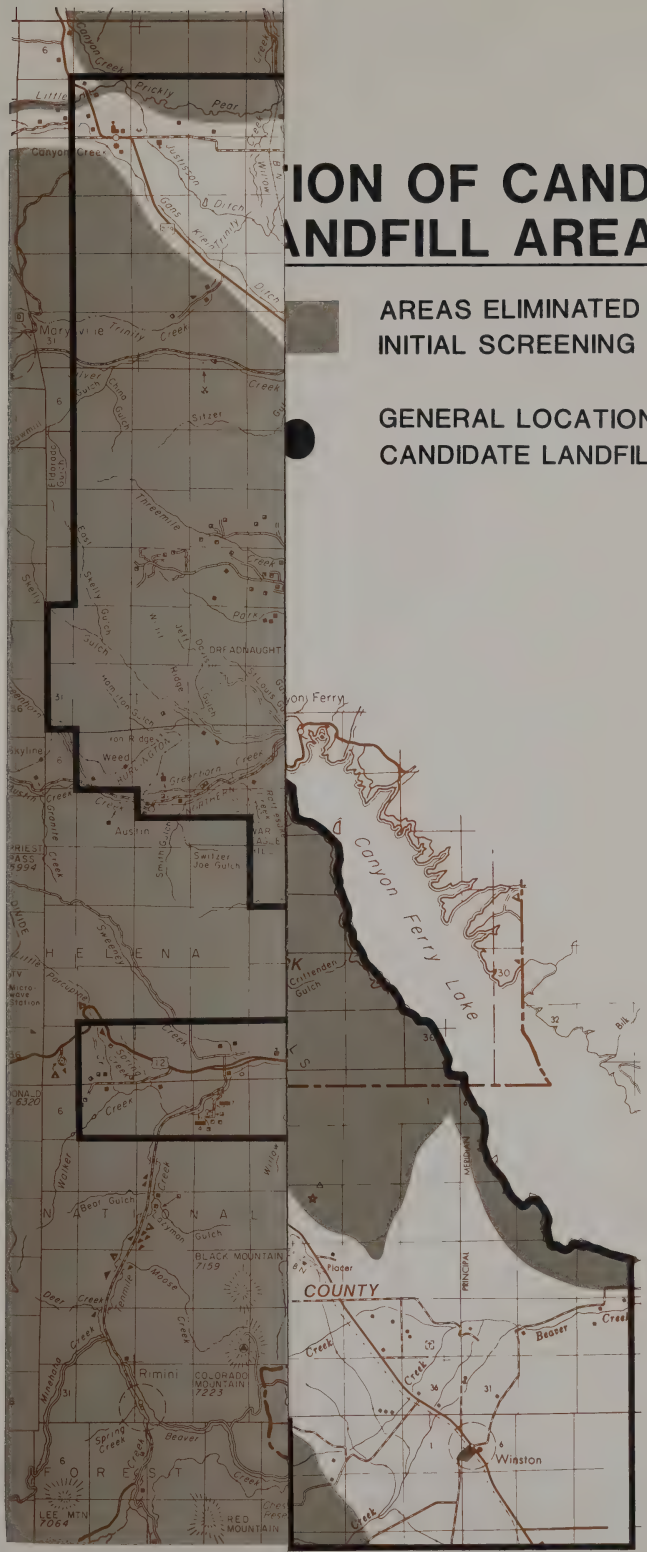
The general positive and negative aspects of each of the 16 potential candidate sites were then discussed with the study committee in detail. Several of the committee members correspondingly conducted their own windshield survey of the 16 areas as well and identified additional areas that may warrant consideration. Once this field work was concluded, the study committee and the consultant met once again to finalize the location of the sites that would be further evaluated. Based on this meeting, eight candidate areas were selected. The general location of the eight areas are depicted on Figure 3.

Figure 3

ION OF CANDIDATE
ANDFILL AREAS

AREAS ELIMINATED DURING
INITIAL SCREENING ANALYSIS

GENERAL LOCATION OF
CANDIDATE LANDFILL AREAS



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&
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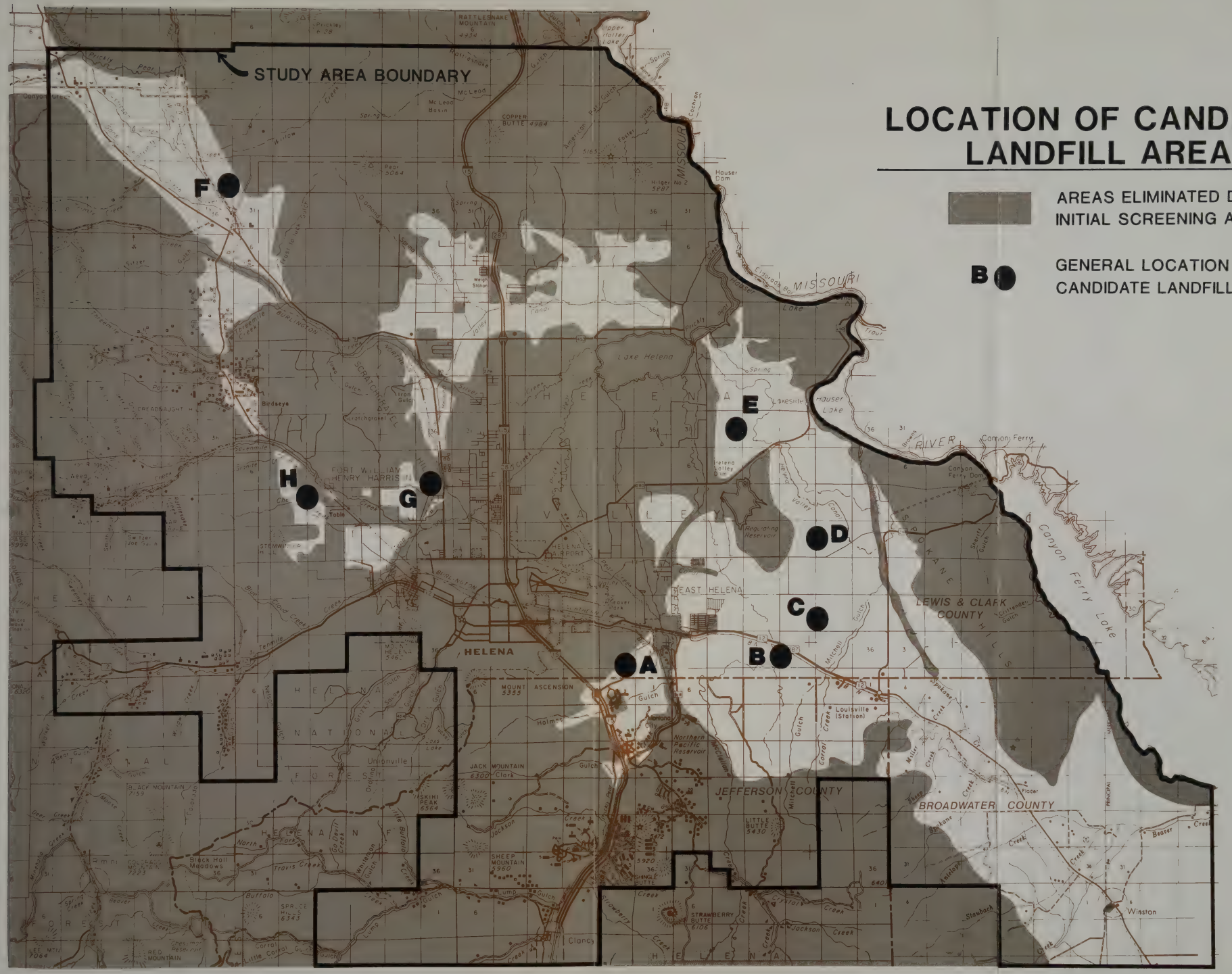
Helena, MT

Figure 3

LOCATION OF CANDIDATE LANDFILL AREAS



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II. GENERAL DESCRIPTION OF AREAS

Once the eight candidate areas were selected, the consultant assembled more specific information from each area. This information was then utilized to conduct a rating analysis that ranks each of the sites relative to one another. Included in the following text is a brief description of each of the eight candidate areas.

A. CANDIDATE AREA A

1. Location

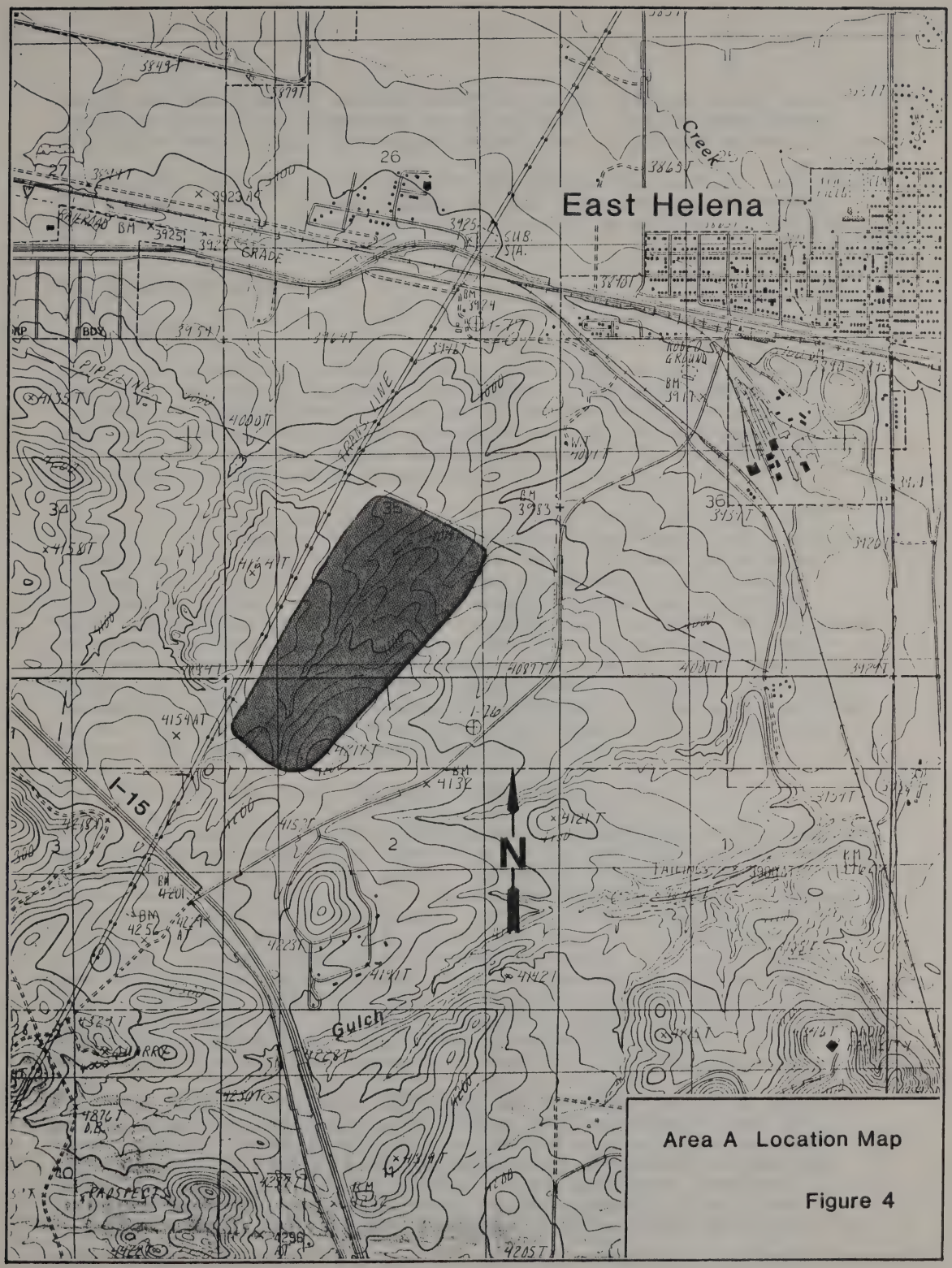
Area A is generally located 1-2 miles southwest of East Helena. The site primarily consists of the top end of a major drainage that initiates near Interstate 15. The area consist of approximately 200 acres and is basically bordered by power lines on the northwest, a natural gas pipeline to the northeast, the highway from East Helena to Interstate 15 on the southeast and Interstate 15 to the southwest. The location of the area is depicted on Figure 4.

In respect to access, the primary highway leading to East Helena would provide an all weather roadway to the site. On-site access would require approximately 1,500 feet of additional roadway to be constructed. The existing land use of the area is primarily agriculture. The closest proximity to development would be a subdivision located approximately two-thirds of a mile south of the site. The majority of the landfill operations for this area would be located within the confines of a large drainage coulee and consequently visual impacts to surrounding areas would most likely not be significant.

2. Hydrogeologic and Physical Conditions

Area A is underlain by Tertiary fluvial deposits comprised primarily of light brown to white sandy siltstone and volcaniclastic sediment with pumic fragments to 2 inches in diameter. Minor quartz and rhyolite sand and rhyolite pebbles are also found in these deposits. Pleistocene gravel deposits with cobbles and boulders are present on several hill tops and ridges in the area. Holocene stream channel deposits are present in ephemeral streams crossing the area and placer tailings and gravel pits are also found in the area. Tertiary deposits are moderately lithified and would likely be ripable for use as cover material for landfill operations.

Well logs from five domestic wells located three-quarters to one mile south of the area indicate that the Tertiary deposits are at least 240 feet thick. Static water levels in the wells average over 100 feet, with the minimum depth to water being 60 feet. Wells completed in the Tertiary deposits generally produce 4 to 8 gallons per minute. This indicates a low or very low permeability for the Tertiary aquifer material. Pleistocene gravel deposits are relatively thin and unstaturated in the area. Al-


East Helena
Creek
Gulch
I-15
N
Area A Location Map
Figure 4

though no wells exist in the immediate area, ground water use could be for either domestic or stock use. Limited quantities available would limit the agricultural use of ground water.

Above-site drainage is limited by Interstate 15, and is less than 0.5 square miles. Ground slopes in the area are approximately five percent, and seismic risk is low with no active or inferred faults within 500 feet of the site.

B. CANDIDATE AREA B

1. Location

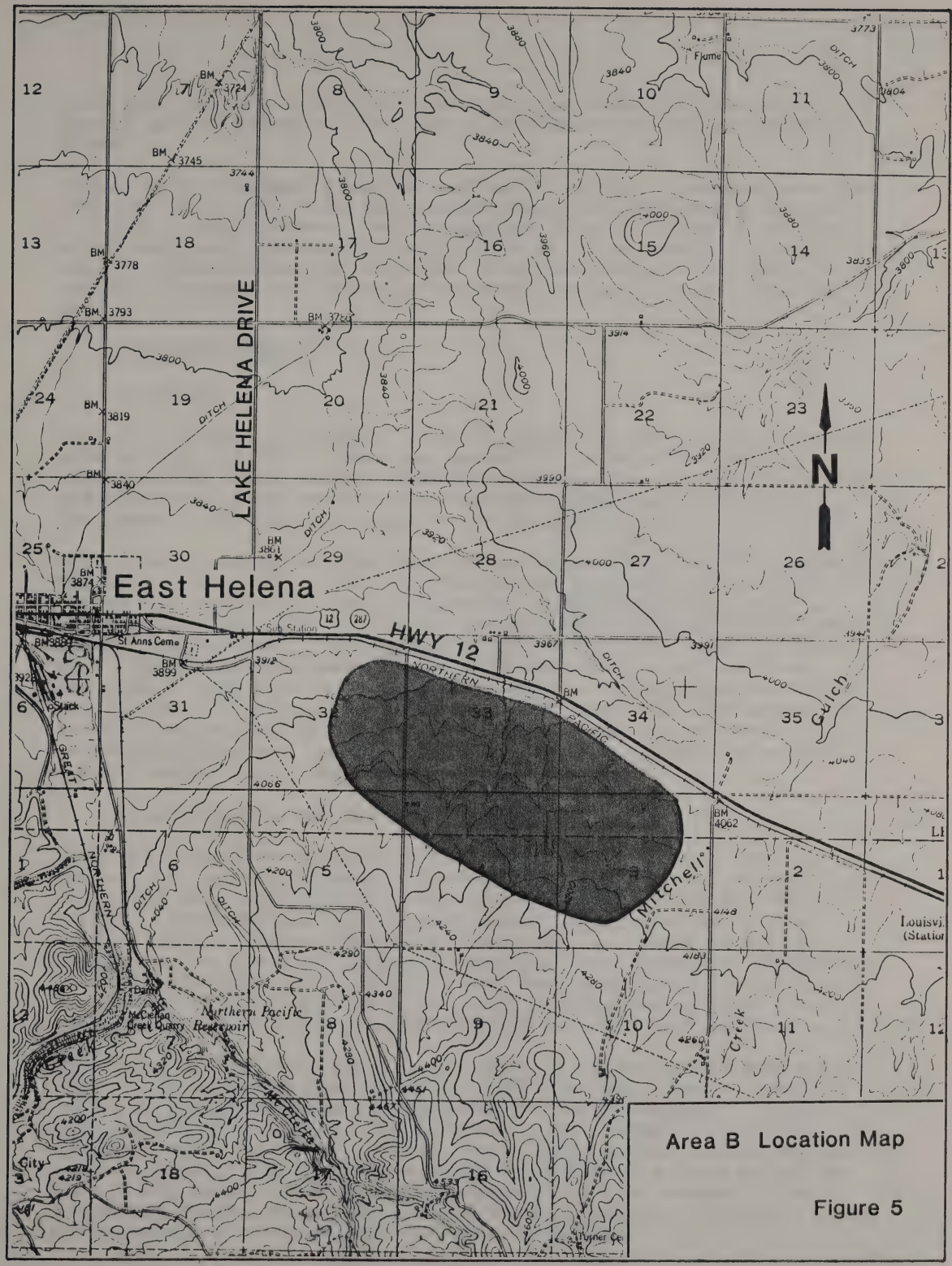
Area B is generally located 1 to 3 miles east of East Helena and partially extends into Jefferson County. The area generally extends for approximately 2 miles in an east-west direction and for 1 mile in a north-south direction and is located parallel to and south of the Burlington Northern tracks. The location of this area is depicted on Figure 5.

Access to the area would be on U.S. 12/287 which provides an excellent all weather highway. Depending upon the exact location of the landfill, approximately 1,000 to 5,000 feet of improved roadway would have to be constructed along with a Burlington Northern railroad crossing. The existing land use is agriculture. Depending upon the exact location of the site, the closest proximity to the nearest dwelling would be approximately one-quarter to one-half mile in distance. Due to the relatively flat slopes in the area, the landfill would most likely be a trench operation. Visual impacts would be minimal for the most part due to the high grade of the Burlington Northern tracks which would obscure the area from Highway 12/287.

2. Hydrogeologic and Physical Conditions

Area B is underlain by Tertiary deposits consisting predominantly of light brown sandy silt layers up to 10 feet thick with some interbeds of silty, sandy gravel layers up to 6 feet thick. Gravel and cobble clasts to 6 inches in diameter comprise approximately 80 percent of the gravel layers. Overlying the Tertiary deposits in the central portion of the area is Pleistocene gravel alluvium. Median size of the gravel alluvium is 1 to 2 inches, however, cobbles and boulders also are present in minor quantities. Tertiary deposits would be ripable and make reasonably good cover material. Pleistocene gravel deposits would be more difficult to work with due to the presence of cobbles and boulders, and also are more permeable than the Tertiary deposits.

Two well logs in the area indicate the Tertiary deposits extend at least to 200 feet, and possibly to depths greater than 500 feet. Static water levels in the two wells are at 83 feet and 160 feet. Well yields from the two wells completed in the Tertiary deposits were around 30 gpm. This indicates that the Tertiary deposits have a moderate to low permeability. The closest domestic well is in the center of the area, and could be



Area B Location Map

Figure 5

1000 feet to over 5000 feet from a proposed landfill location. Use of ground water in the area is for domestic and stock purposes.

Approximate drainage areas of ephemeral streams transgressing the area are variable, with the largest drainage area being between 1.5 and 3 square miles. An irrigation ditch is located in the area, and could be located within 1 mile of a potential landfill site. Ground slopes in the area vary from two to nine percent and the distance to active or inferred faults is more than 500 feet.

C. CANDIDATE AREA C

1. Location

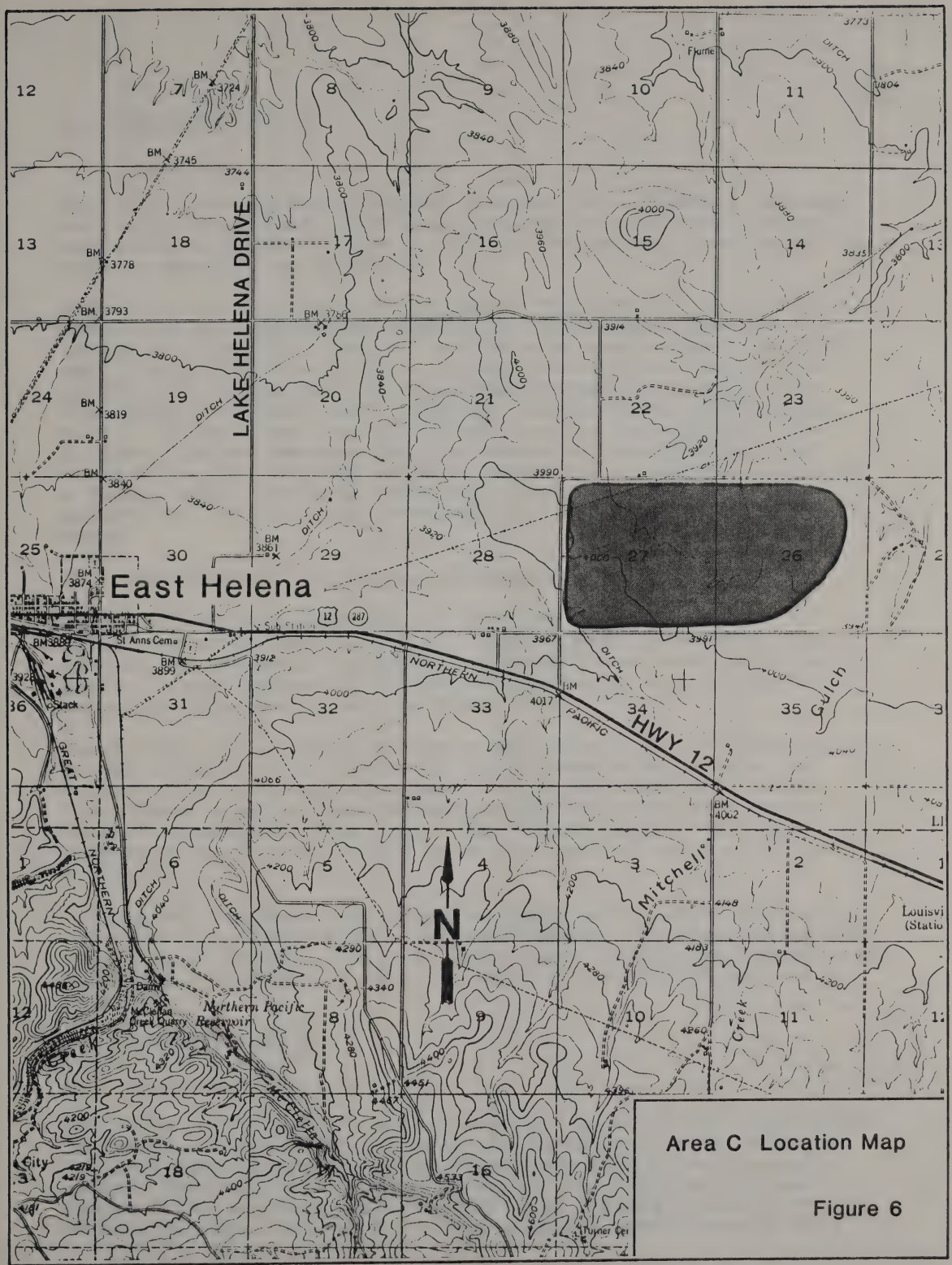
Area C is basically located directly north of Area B on the north side of U.S. 12/287. The area generally extends for approximately 1,000 acres and is basically bordered by Mitchell Gulch on the east and local access roads on the remaining three sides. The general location is depicted on Figure 6.

Like Area B, access to the area would be on U.S. 12/287. Depending upon the exact location of the site, approximately one-half to one and one-half miles of improved roadway would have to be constructed from U.S. 12/287 to the entrance. The existing land use is agriculture. The proximity to the nearest dwelling would most likely be a minimum of one mile depending upon the exact location. Like Area B the site would be a trench type operation due to the flat slopes in the area. The area would be somewhat visible to traffic on U.S. 12/287, even though it would be located approximately one mile from the highway. Thus the visual impacts would most likely be minimal.

2. Hydrogeologic and Physical Conditions

Geologic materials underlying this area are Tertiary deposits similar to those in Area B. Several ephemeral stream channels cross the area and contain thin Holocene sand and gravel deposits. Tertiary deposits would likely be ripable and provide good, workable cover material for a landfill. Four well logs available for the area indicate that Tertiary deposits extend to at least 180 feet, with static water levels ranging from 21 to 80 feet. Well yields vary from 15 to 25 gallons per minute, indicating moderate to low permeability of the Tertiary aquifer.

Depending on the location of the landfill, the closest domestic well could be 2,000 feet to 7,000 feet from the site. Ground water is used for domestic and stock watering purposes. Limited agricultural use may also be possible. No springs or ditches are located within two miles of the site. The maximum drainage area above a landfill in this area would be 1.5 to 2 square miles in size. Slopes at the site are approximately two percent. Two concealed faults cross the general area, however, a landfill would likely not be located directly on either.



Area C Location Map

Figure 6

D. CANDIDATE AREA D

1. Location

Area D is located approximately 8 miles east of Helena adjacent to Canyon Ferry Road. The area consists of approximately 600 acres and is bisected by Hart Drive. The general location of the area is depicted on Figure 7.

Access to the area would be on Canyon Ferry Road. It is anticipated that the additional traffic on Canyon Ferry Road as a result of a landfill located in this area would impact the roadway. It may be necessary to improve Canyon Ferry Road to the landfill to accommodate the possible increased traffic. Hart Lane would also have to be improved for approximately one-half mile. The existing land use in the area is agriculture. The proximity to the nearest dwelling would be approximately one-third mile. The typical landfill operation of the site would be a trench type. The area would most likely have some visual impacts due to the close proximity of Canyon Ferry Road and Hart Drive.

2. Hydrogeologic and Physical Conditions

Area D is entirely underlain by Tertiary deposits similar to those present in Areas B and C. Several small drainages originate in the area and contain thin alluvial sand and gravel deposits. Data from wells in the area indicate that the Tertiary deposits are greater than 130 feet thick.

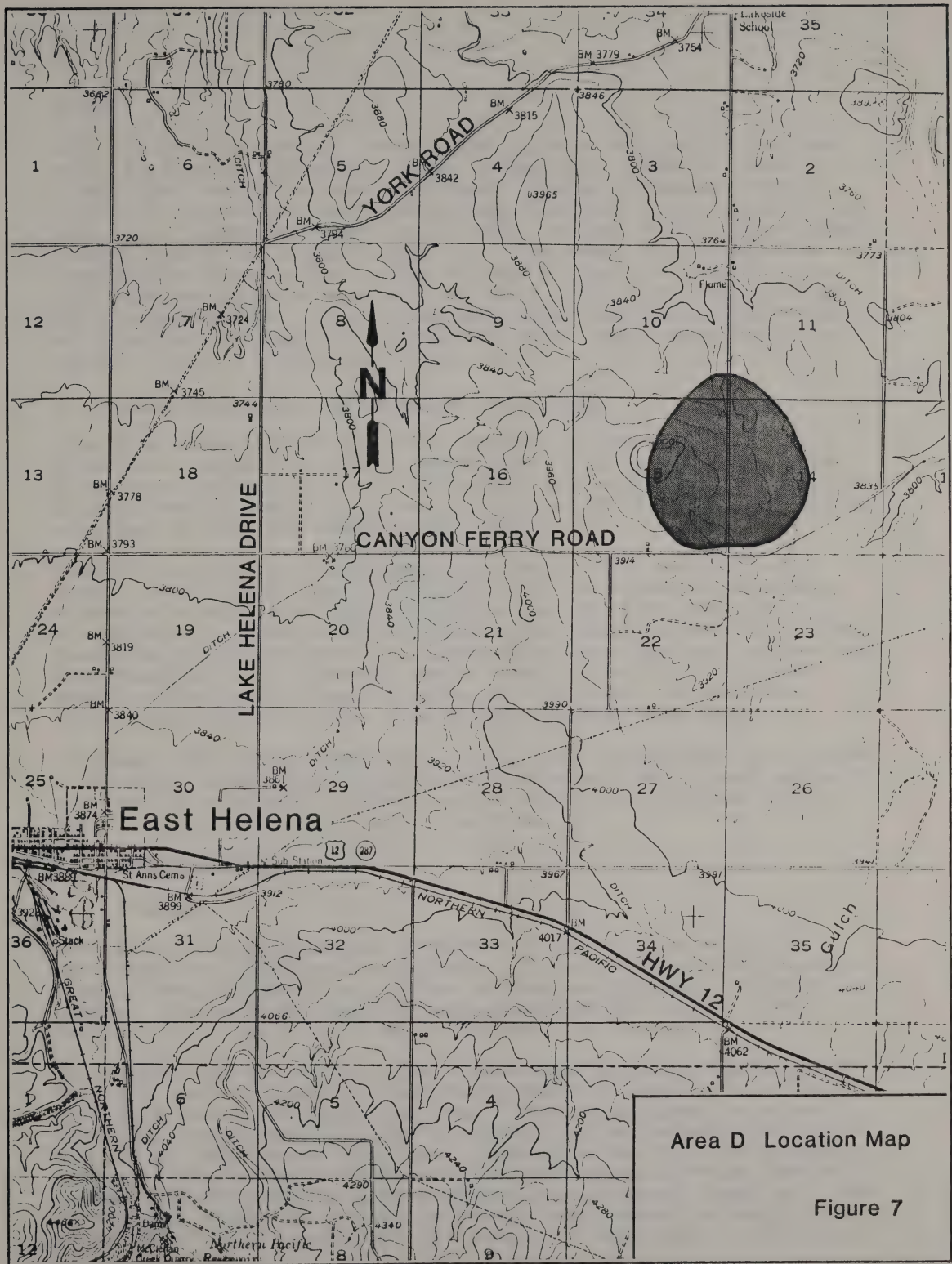
Water levels of wells in the area vary from 20 to 100 feet below ground surface. Wells yield 19 to 30 gallons per minute, indicating low to moderate permeability in the Tertiary aquifer. The closest domestic well would be 2,000 to 5,000 feet from a landfill located in this area. The Helena Valley canal also traverses the site and could be within one half mile of a landfill site.

The maximum drainage area above any site in the area would be less than 0.5 square miles. Ground slope in the area varies from two to three percent. An inferred/covered fault also crosses the southwest corner of the site and could be within 500 feet of a landfill.

E. CANDIDATE AREA E

1. Location

Area E is located approximately one mile south of the Lake Helena Causeway. As indicated on Figure 8, the general area actually includes two sub areas located within one-half mile of each other. The candidate area is generally located east of Lake Helena Drive and west of the power lines running from Hauser Dam to East Helena. The two sub areas comprise approximately 500


YORK ROAD
LAKE HELENA DRIVE
CANYON FERRY ROAD
East Helena
HWY 12
NORTHERN PACIFIC
GREAT NORTHERN
Lakeside School
Flume
St Anns Cemo
Sub Station
Gulch
Area D Location Map
Figure 7

acres.

With respect to access, the primary highway leading to the area would be Highway 280 which leads to Lakeside. This highway is in fairly good condition and could most likely accommodate the potential increased travel resulting from locating a landfill in this area. Approximately 1 to 2 miles of Lake Helena Drive would likely have to be improved however. The area is primarily unuseable for farming due to the extreme slopes. A landfill in this area would be an area cut and fill type operation. Due to the close proximity to existing dwellings (one-half mile or less) and the steep slopes, it is possible that precautions would be needed to avoid potential visual impact.

2. Geohydrological and Physical Conditions

Area E is underlain by Tertiary deposits consisting of clay, siltstone, arkosic sand and gravel beds, and thin lignite beds. These deposits are partially lithified and would provide adequate to good cover material. A well to the north of the area likely remained in Tertiary deposits to 740 feet.

Static water levels vary from 97 to 190 feet in wells in the area. Yields vary from 2 to 20 gallons per minute, indicating moderate to very low permeability of the Tertiary aquifer. Ground water in the area is suitable for domestic and stock use. No agricultural use would be likely given the low well yields and deep water levels. Domestic wells are located 2,000 to 5,000 feet from potential landfill sites in the area. A spring is located approximately one mile to the north of the area.

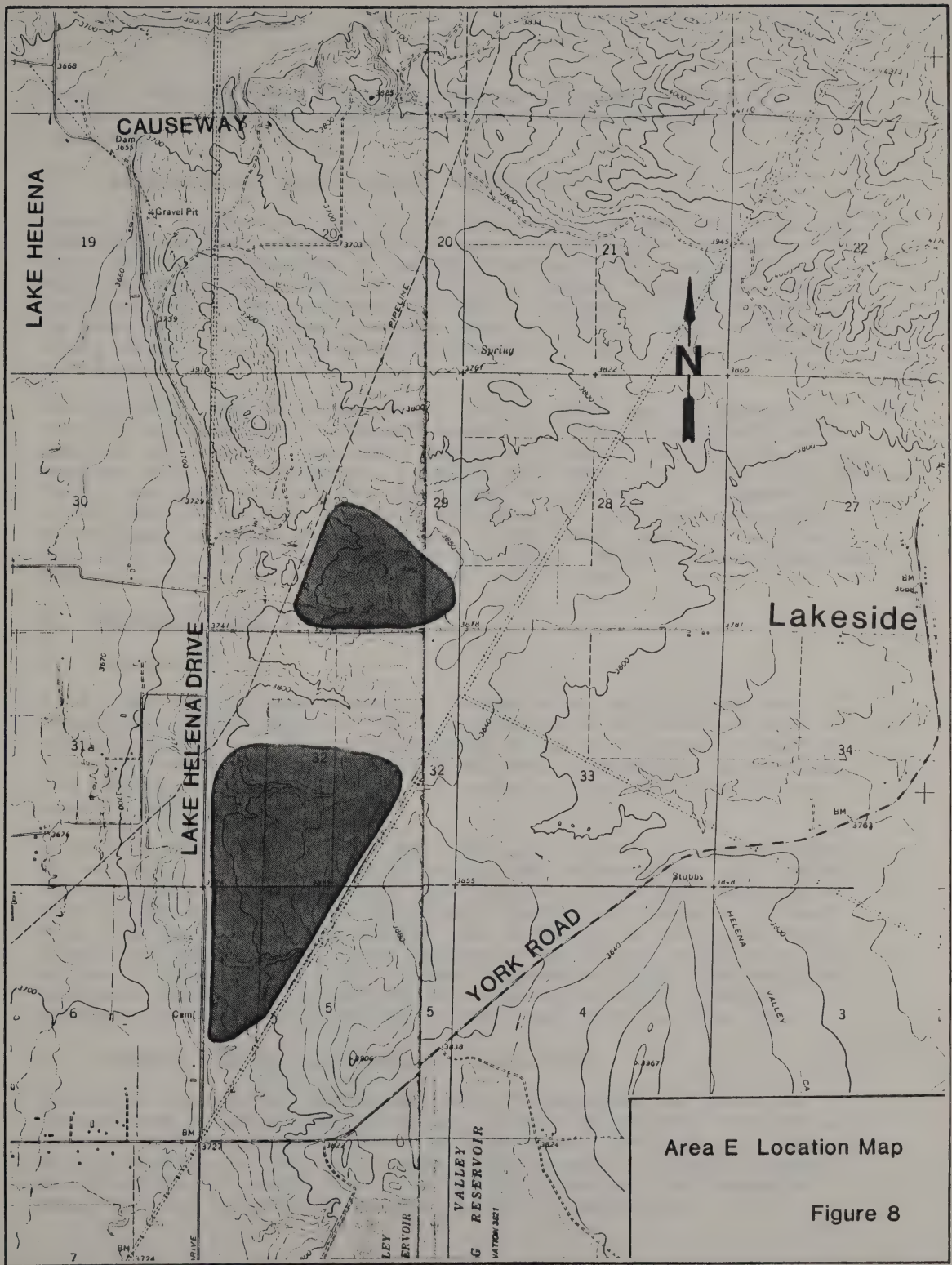
Drainage areas in the area are small, with the maximum size above a potential site being less than 0.5 square miles. Land slope in the area is moderate to steep and no faults or inferred faults are located within 500 feet of the area.

F. CANDIDATE AREA F

1. Location

Area F is located immediately north of Silver City which is approximately 16 miles from Helena. The area extends for approximately one mile parallel to the Burlington Northern railroad tracks. The area consists of approximately 600 acres. The general location of the area is depicted on Figure 9.

The primary access to the site from Helena would be Highway 279. This all weather roadway would be capable of handling the traffic to a proposed landfill in the area. Depending upon the actual location, approximately 1,000 to 4,000 feet of access road would have to be improved to the area. Currently the site is used for grazing. The nearest dwelling is located approximately one-half to one mile from the site depending upon the exact location. Due to the flat slope of the area a trench type operation would be used. Due to the relatively low number of dwellings in the area


CAUSEWAY
LAKE HELENA
LAKE HELENA DRIVE
YORK ROAD
Lakeside
Gravel Pit
Spring
Stubbs
N
Area E Location Map
Figure 8

coupled with the fact that the highway is approximately one-half to one mile from the area, very minimal visual impact could be expected.

2. Hydrogeologic and Physical Conditions

Area F is located outside of the Helena Valley and only regional geologic mapping and information are available for the area. The site generally consists of gently sloping (2 to 3 percent) alluvial and colluvial deposits below Belt Series Precambrian rocks outcropping to the northeast. Depth to bedrock is estimated to be greater than 50 feet over the area. Wells drilled at the south edge of the area encountered alluvium to a total depth of 168 feet.

Static water levels in two wells at the south end of the site were 98 and 100 feet. Claimed beneficial use of each well is 8 gallons per minute. No other wells are present in the area. The nearest well to a potential landfill site would be 5,000 to 10,000 feet. Aquifer permeability is likely medium to low. Ground water use in the area would be for domestic and stock watering. An irrigation ditch does flow across the site, possibly within one-half mile of potential landfill sites. No faults or inferred faults are located within 500 feet of the area.

G. CANDIDATE AREA G

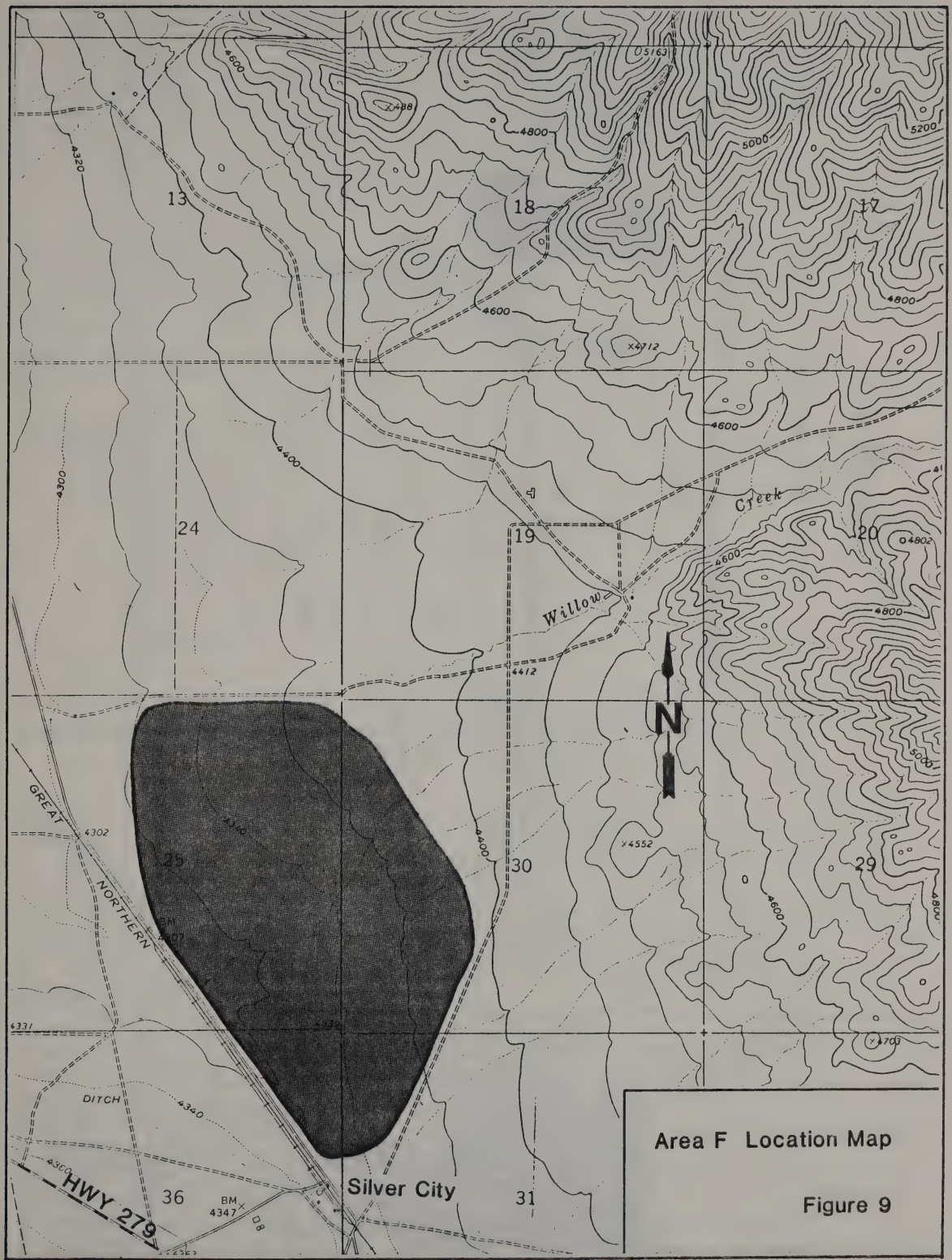
1. Location

Area G is located approximately three miles north of Helena immediately north and west of the existing Scratchgravel District's landfill. The Scratchgravel Hills are located north of the site and Burlington Northern Railroad tracks are located on the eastern edge of the area. The approximate location of the area is depicted on Figure 10.

Access to the site would be good through the use of Green Meadow Drive, which is planned for widening and improvement, and Franklin Mine Road. Approximately one-quarter to one-half mile of on site access road would be required. Currently the site is used on a limited basis for grazing. The majority of the site would likely utilize a trench type operation due to the relatively flat slopes on much of the site. Visual impacts of the site could be moderate to significant due to the close proximity to major subdivisions and dwellings to the east and south of the area.

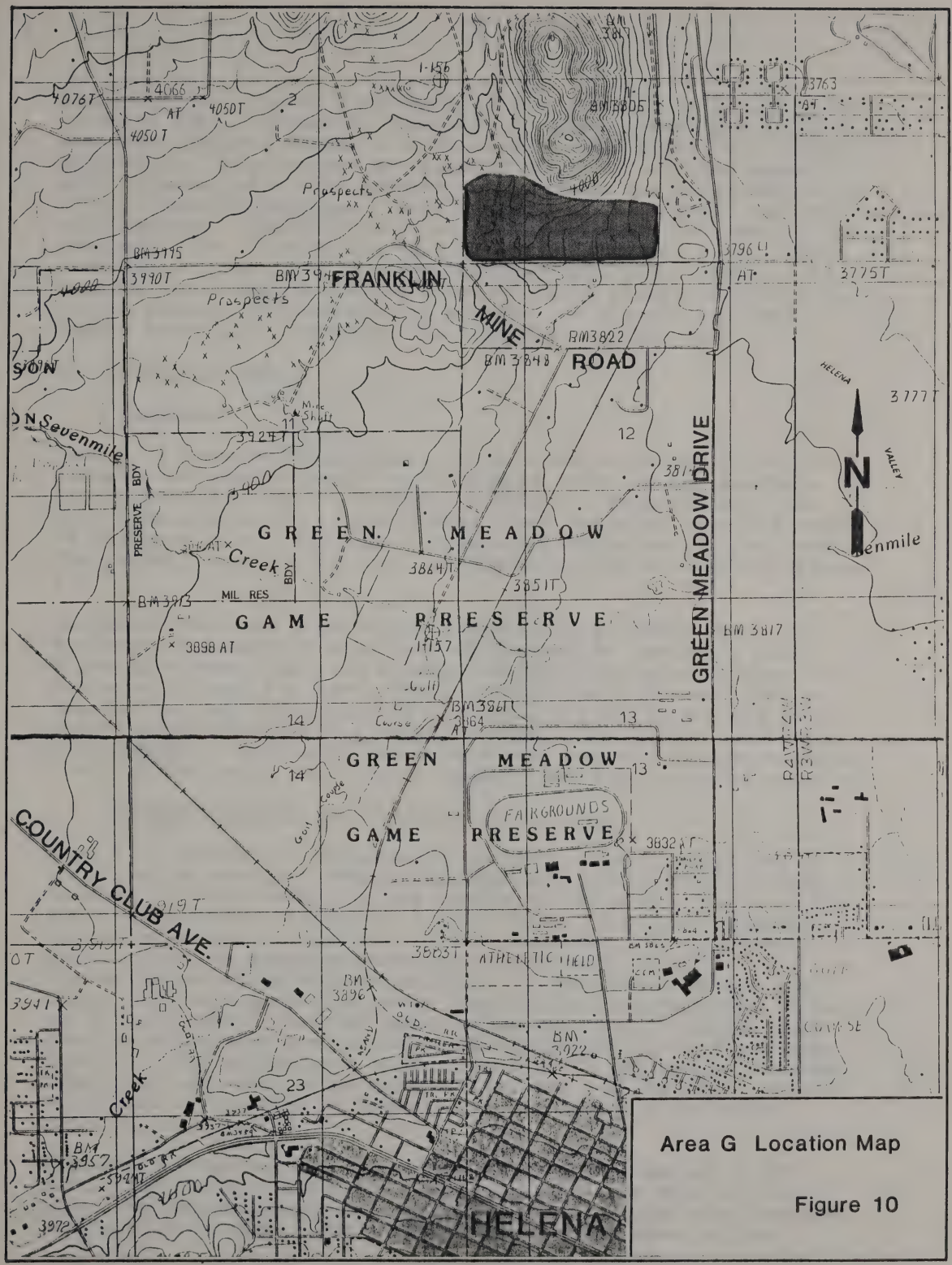
2. Geohydrological and Physical Conditions

Area G is covered by relatively thin Pleistocene and Holocene terrace and alluvial fan deposits. Depths to diorite bedrock are 6 to 16 feet immediately south of this area. Bedrock is present at the surface at the north edge of this area. Alluvial deposits are comprised of sand, silt, and cobble gravel. This material would be good cover material for landfill operations.



Area F Location Map

Figure 9



Area G Location Map

Figure 10

Water levels in wells just south of the proposed area vary from 31 to 41 feet. Hydraulic conductivity of the bedrock aquifer at the Scratchgravel landfill to the south range from .0014 to .0008 cm/second. These values are typical of relatively low permeability materials. The primary downgradient use of ground water is for domestic purposes. Some stock and agricultural uses are also present. Domestic wells are present within 500 feet of this proposed site. The Helena Valley Canal is located within one-half mile of the site, and the drainage area above the site is less than 1/2 square mile is size. Surface slopes vary from four to ten percent and average six percent. A normal fault was mapped by Schmidt (1986) on the east edge of this site.

H. CANDIDATE AREA H

1. Location

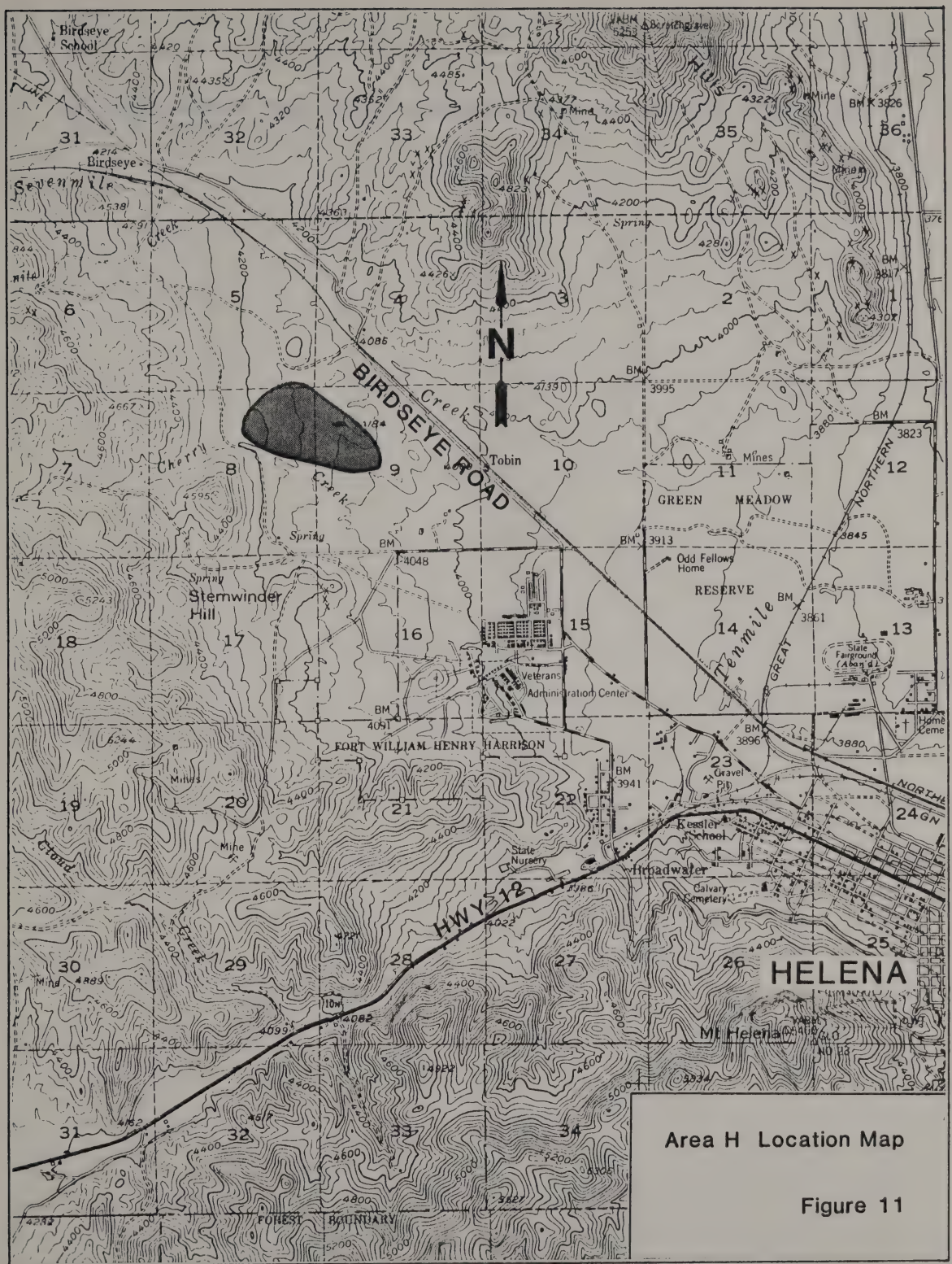
Area H is located approximately five miles northwest of Helena. The site is approximately one-half mile north of the northern property line of the Fort Harrison Military Reservation. The area lies just north of the Cherry Creek drainage area and south of Birdseye Road. The area encompasses approximately 200 acres. The general location of this candidate area is depicted on Figure 11.

Access to the area from Helena would be on Birdseye Road. It would be necessary to construct approximately one and a half miles of access road from Birdseye Road to the area. Currently the area is used for agriculture and grazing purposes. Due to the rolling and topography of the area, a partial cut and fill and trench type operation would be used. Due to the relatively high number of residents and subdivision activity to the east and north of the area, some visual impacts could possibly be expected.

2. Geohydrological and Physical Conditions

Area H is covered by Pleistocene pediment gravel, comprised of sandy, silty gravel. Bedrock exposures surround this site and bedrock is also present in the center of the area. Wells to the south encountered bedrock at 9 to 69 feet. Depth to bedrock is likely less than 20 feet for much of the area. The pediment gravel would be adequate cover material for a landfill. Wells to the south encountered water at 50 to 70 feet below ground surface. The average ground water level in the area appears to be at 50 to 60 feet. Bedrock material at the site is likely granite. A relatively low permeability is typical of most granitic rocks. Wells in the area yield from 3 to 20 gallons per minute. This also indicates a low permeability for the aquifer. Ground water use in the area is principally for domestic and stock watering purposes.

Distance to the nearest domestic well is approximately 2,000 feet. An irrigation ditch is located within one mile of the site, and the drainage area above the site is less than one half square mile in size. The average slope in the area is four



Area H Location Map

Figure 11

percent, and no faults or inferred faults are located within 500 feet of the area.

III. DEVELOPMENT OF RATING SYSTEM

To evaluate the eight (8) candidate landfill areas selected by the study committee and consultant, a rating system was developed by the consultant. Initially to develop the rating system the consultant and the study committee reviewed the 37 rating criteria that were developed during the initial screening process. These criteria were then reduced with some criteria eliminated and others grouped together. Ultimately 29 specific criteria were selected for use in conducting the evaluation and ultimate rating of the 8 selected candidate areas.

Each of the 29 criteria selected were assigned a weighting factor depending upon their importance and significance. The weighting of the criteria varied from 1 to 5 with a 5 rate factor representing the most significant and a 1 factor representing the least significant criteria. The listing of the criteria as well as the weighting of each as determined by the consultant and study committee is depicted on Table 3.

Once the weighting factors were finalized, the consultant developed specific ranking requirements for each of the 29 specific criteria. These requirements would then be used to rate each of the eight candidate landfill areas. For each criteria category, the ranking requirements were developed on a 1 to 5 basis with a 5 rank indicating the most suitable situation for locating a landfill and a 1 rank indicating the least desirable situation for locating a landfill. This ranking data was then reviewed by the study committee and modifications were made as agreed upon by the committee. The final ranking requirements that were used to rate each candidate area is summarized in Table 4.

TABLE 3

RANKING CRITERIA WEIGHTING ANALYSIS

WEIGHT=5

- Depth to Water
- Depth to Bedrock
- Land Use Potential
- Proximity to Population Density (Aesthetics)
- Proximity to Waste Centroid (Transportation Costs, etc.)
- Site Operational Costs
- Surficial Materials
- Base Materials

WEIGHT=4

- Aquifer Permeability
- Current Land Use & Zoning
- Cultural & Historical
- Site Development Costs

WEIGHT=3

- Groundwater Quality & Use
- Distance to Domestic Wells
- Scenic Value
- Threatened Species
- Transportation Network
- Size of Parcel
- Air Quality

WEIGHT=2

- Above Site Drainage Area
- Slope
- Distance to Springs, Ditches
- Distance to Paved Roadways
- Distance to Available Electricity
- Jurisdictional Constraints

WEIGHT=1

- Climatology
- Seismic Risk Zones
- Wildlife
- Noise

Table 4

RANKING REQUIREMENTS

CRITERIA	WEIGHT	RANK				
		1	2	3	4	5
Depth to Water	5	< 20'	20' - 40'	40' - 60'	60' - 80'	> 80'
Depth to Bedrock	5	< 10'	10' - 20'	20' - 35'	35' - 50'	> 50'
Surficial Materials	5	Large rocks predominant	Clean sand or gravel	Silty or clayey sand and gravel	Clay	Sandy Clay
Base Material	5	Clean sand & gravel Karst Limestone	Metamorphics, igneous, volcanics	Sand & gravel with significant clay, sandstones & massive limestone	Mudstones & ash	Silt & clay, shale
Land Use Potential	5	The land has good potential for higher uses	Adjac. land is developable. Presence of landfill may degrade desirability	Land may have potential but similar type land is abundantly available	Area has no potential for productive use without change by man	Land has no inherant potential
Proximity to Population Density (Aesthetics)	5	Site is within one mile of town or city boundary	Site is within one mile of subdivision	Site is within one mile of subdivision or growth	Site is within one mile of residences	Site is in uninhabited area; no residences within 2 miles
Proximity to Waste Centroid (Transportation Costs)	5	> 15 Miles	11 - 15 Miles	7 - 11 Miles	3 - 7 Miles	< 3 Miles
Site Operational Costs	5	Extremely High		Moderate		Relatively Low

Table 4 (continued)

RANKING REQUIREMENTS

CRITERIA	WEIGHT	RANK				
		1	2	3	4	5
Aquifer Permeability	4	High	Medium	Low	Very Low	Practically Impermeable
Cultrual & Historical	4	Significant sites are known to exist on site	Cultural sites of minor importance have been found on site	Area was known to be inhabited in pre-historic times	Area may have possibility but none are known	No known sites
Current Land Use	4	A change in land use would directly effect livelihood of surrounding owners	A change in land use would impact surrounding landowners	Site would disrupt existing use but adjacent land could be traded	Current use of site is considered low in quality compared to adjacent land	A change in land use would have little effect on adjacent existing landowners
Site Development Costs	4	Extremely High		Moderate		Relatively Low

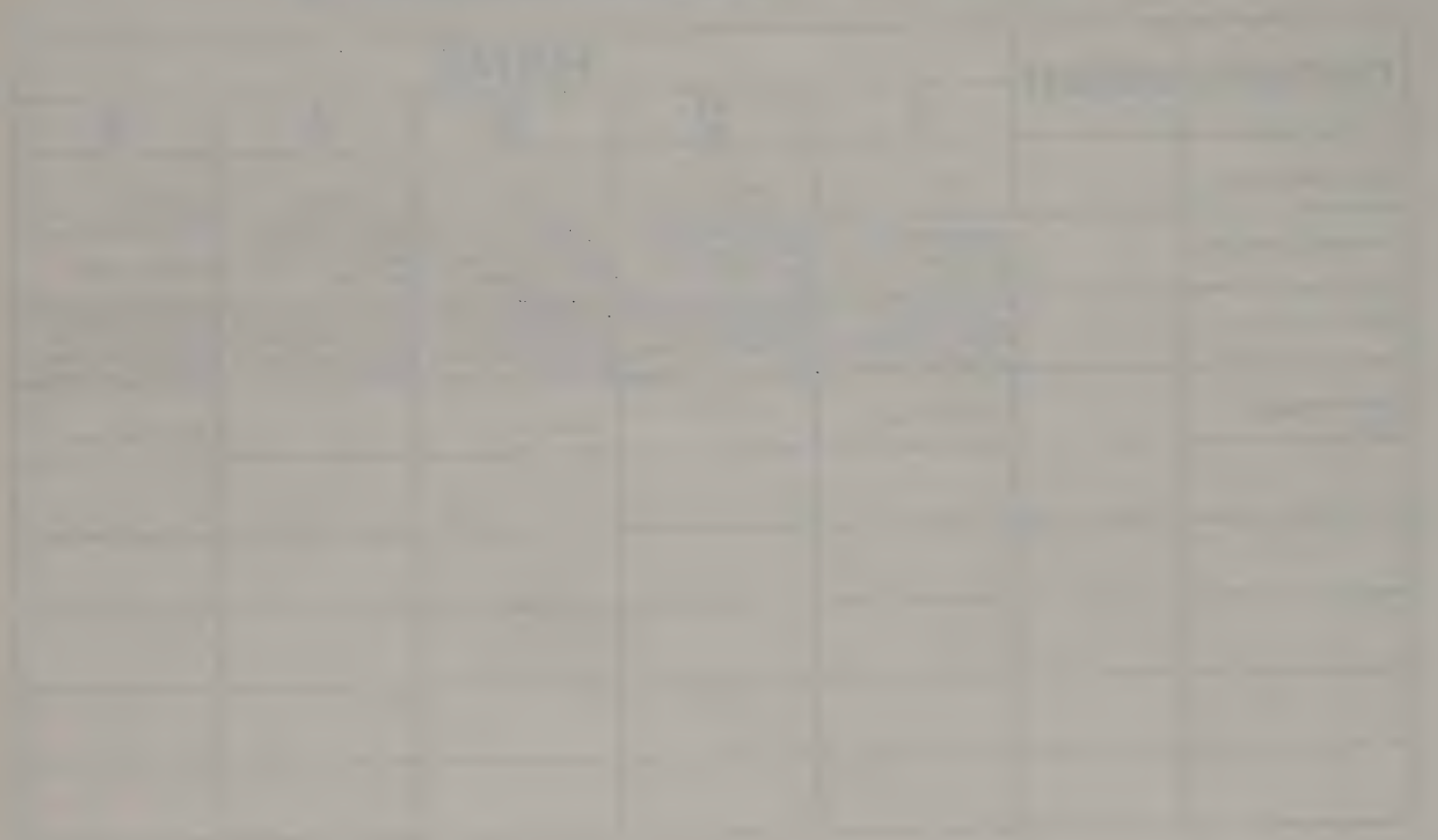


Table 4 (continued)

RANKING REQUIREMENTS

CRITERIA	WEIGHT	RANK				
		1	2	3	4	5
Distance to Domestic Wells	3	0 - 500'	500' - 2,000'	2,000' - 5,000'	5,000' - 10,000'	>10,000'
Groundwater Quality & Use	3	Domestic Supply (Excellent)		Agricultural Water Supply (Moderate)		Not Used (Poor)
Threatened Species	3	Species are known to currently or recently inhabit area	Prior use of area, no siting in last 5 years within 2 miles	Area contains suitable habitat	Area contains suitable habitat, however, similar type habitat is abundant	No known species
Transportation Network	3	Average secondary with substantial congestion	Fair secondary roadway with moderate congestion	Mostly secondary roadway with minimal congestion	75%-100% primary, remainder good secondary	Excellent primary roadway to site
Scenic Values	3	Site has high recreational use or is visible from main highway	Site is clearly visible to highly populated areas	Site is visible to residents of existing or planned developments	Site is not visible from high use areas or public areas	Site is not visible to any residents or planned developments
Size of Parcel	3	<40 Acres	40 - 80 Acres	80 - 120 Acres	120 - 160 Acres	>160 Acres
Air Quality	3	Near areas where air quality is excellent & highly critical		In areas where air quality is moderately critical	In rural areas where quality is somewhat critical	In rural areas where air quality is not critical

Table 4 (continued)

RANKING REQUIREMENTS

CRITERIA	WEIGHT	RANK				
		1	2	3	4	5
Distance to Springs, Ditches, etc.	2	On Site	0 - ½ Mile	½ - 1 Mile	1 - 2 Miles	> 2 Miles
Above Site Drainage Area	2	> 5 Sq Miles	5 - 3 Sq Miles	3 - 1½ Sq Miles	1½ - ½ Sq Mile	< ½ Sq Mile
Distance to Paved Roadways	2	> 2 Miles	1 - 2 Miles	½ - 1 Mile	¼ - ½ Mile	< ¼ Mile
Distance to Available Electricity	2	> 1 Mile	½ - 1 Mile	¼ - ½ Mile	0 - ¼ mile	On Site
Slope	2	0 - 2% or > 15%	10 - 15%	8 - 10%	5 - 8%	2 - 5%
Jurisdictional Constraints	2	Located in adjacent County with officials not agreeable to cooperate		Located in adjacent County with officials agreeable to cooperate		Located in Lewis & Clark County

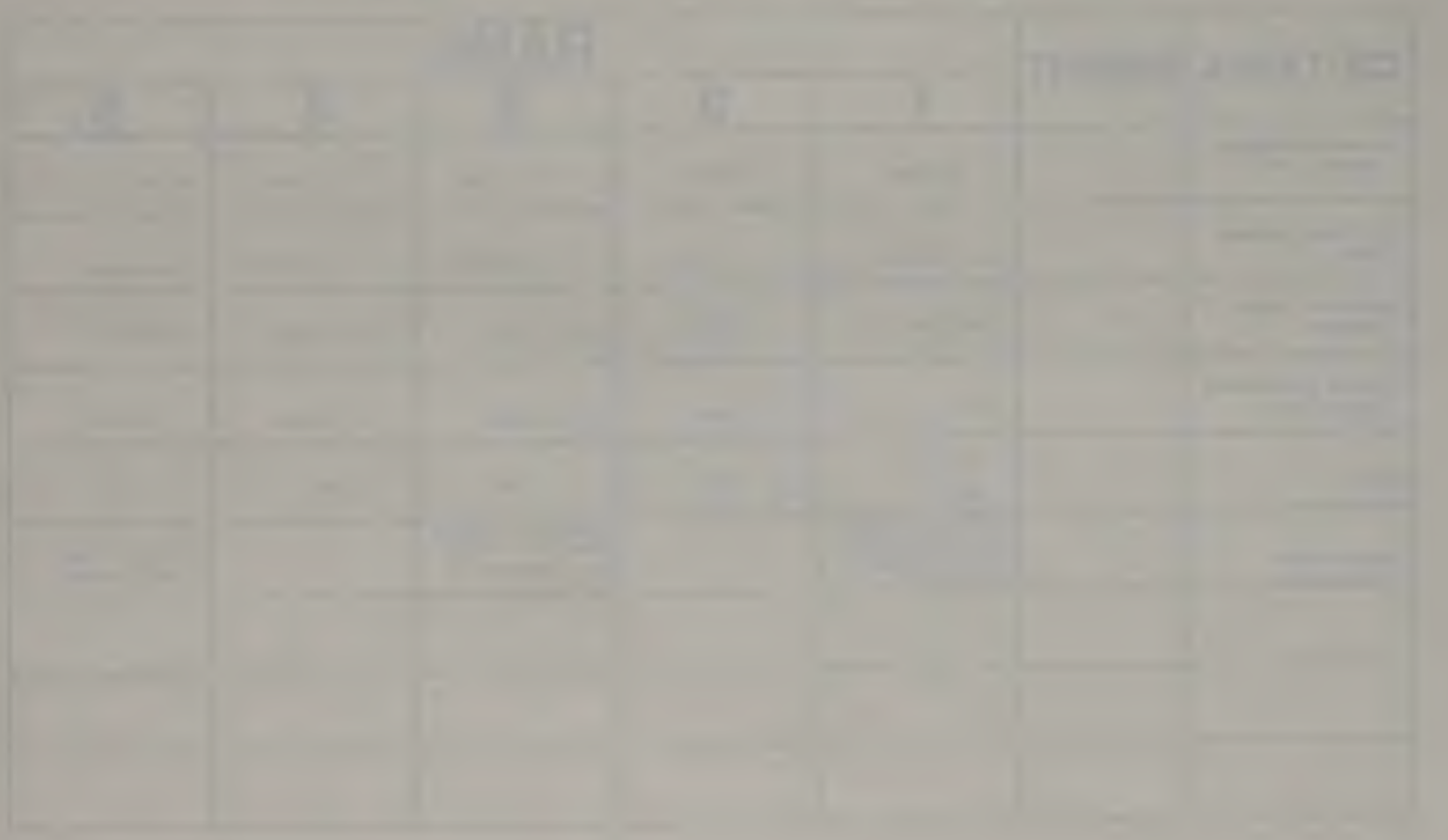


Table 4 (continued)

RANKING REQUIREMENTS

CRITERIA	WEIGHT	RANK				
		1	2	3	4	5
Seismic Risk Zones	1	On fault		On inferred fault		> 500' to fault or inferred fault
Noise	1	Near areas where an increase in noise levels would be critical		Near areas where an increase in noise levels may have a moderate impact		In areas where an increase in noise levels is relatively unimport.
Wildlife	1	In areas of high wildlife use with very little or no adjacent habitat	In areas of high wildlife use with abundant adjacent habitat	In areas of moderate wildlife use	In areas of little known wildlife use	In areas of no known wildlife use
Climatology	1	Extremely windy with high precipitation		Moderately windy & precipitation conditions		Low wind & precipitation conditions

IV. CONDUCT RATING ANALYSIS

Upon completion of the development of the ranking system, the consultant developed a matrix to quantify the actual rating of each candidate landfill area. The matrix basically involved multiplying the appropriate rank as determined by the consultant and committee by the appropriate weighting factor for each criteria for each candidate area. The results of this work is summarized on the work sheets in the attached Table 5. The products of the multiplication of each criteria were then totaled to obtain the cumulative rating score for each candidate area. These total rating scores for each area are summarized in Table 6.

As indicated on Table 6 the total rating score of the 8 candidate areas varied from a low of 272 points for Area G to a high of 357 points for Area E. Further analysis shows that the scores for Areas A, B, C, D, E and F are all within four percent of each other whereas Areas G and H are significantly lower than the other six areas. It is also interesting to note that an analysis of the ratings by criteria for Areas G and H indicates that Areas G and H consistently rated lower in almost all of the 29 criteria compared to the other 6 candidate areas.

Table 5

LANDFILL RATING ANALYSIS

CRITERIA	WEIGHT FACTOR	AREA RATING							
		A	B	C	D	E	F	G	H
Depth to Water	5	5	4	4	4	5	4	2	3
Depth to Bedrock	5	5	5	5	5	5	5	2	2
Surficial Materials	5	3	3	3	3	3	3	3	3
Base Material	5	4	4	4	4	4	3	2	2
Land Use Potential	5	2	3	3	3	4	4	4	3
Proximity to Population Density (Aesthetics)	5	2	4	4	4	4	4	2	2
Proximity to Waste Centroid (Transportation Costs)	5	4	3	3	3	3	1	4	3
Site Operational Costs	5	3	2	2	3	3	3	1	2
SUBTOTAL	5	28	28	28	29	31	27	20	20
TOTAL (Ranking x Weight)		140	140	140	145	155	135	100	100

Table 5 (continued)

LANDFILL RATING ANALYSIS									
CRITERIA	WEIGHT FACTOR	AREA RATING							
		A	B	C	D	E	F	G	H
Aquifer Permeability	4	3	3	3	3	3	2	3	3
Cultural & Historical	4	5	5	5	5	5	5	5	5
Current Land Use	4	3	3	3	3	4	5	4	3
Site Development	4	2	3	3	3	3	4	1	2
SUBTOTAL	4	13	14	14	14	15	16	13	13
TOTAL (Ranking x Weight)		52	56	56	56	60	64	52	52

Table 5 (continued)

LANDFILL RATING ANALYSIS									
CRITERIA	WEIGHT FACTOR	AREA RATING							
		A	B	C	D	E	F	G	H
Distance to Domestic Wells	3	3	3	3	3	3	4	1	3
Groundwater Quality & Use	3	3	3	3	3	3	3	3	3
Treatened Species	3	5	5	5	4	4	5	4	5
Transportation Network	3	4	5	5	2	2	3	2	2
Scenic Values	3	3	4	4	4	4	4	3	3
Size of Parcel	3	5	5	5	5	5	5	3	4
Air Quality	3	4	5	5	5	4	5	3	3
SUBTOTAL	3	27	30	30	26	25	29	19	23
TOTAL (Ranking x Weight)		81	90	90	78	75	87	57	69

Table 5 (continued)

LANDFILL RATING ANALYSIS									
CRITERIA	WEIGHT FACTOR	AREA RATING							
		A	B	C	D	E	F	G	H
Distance to Springs, Ditches, etc.	2	3	4	5	2	4	2	2	3
Above Site Drainage Area	2	5	3	4	5	5	4	4	5
Distance to Paved Roadways	2	5	4	2	3	2	2	3	1
Distance to Available Electricity	2	4	3	4	4	4	3	4	4
Slope	2	5	5	5	5	5	5	5	5
Jurisdictional Constraints	2	5	4	5	5	5	5	5	5
SUBTOTAL	2	27	23	25	24	25	21	23	23
TOTAL (Ranking x Weight)		54	46	50	48	50	42	46	46

Table 5 (continued)

LANDFILL RATING ANALYSIS									
CRITERIA	WEIGHT FACTOR	AREA RATING							
		A	B	C	D	E	F	G	H
Seismic Risk Zones	1	5	5	3	3	5	5	5	5
Noise	1	3	5	5	5	4	5	3	3
Wildlife	1	4	4	3	3	4	4	4	4
Climatology	1	3	3	4	4	4	5	5	4
SUBTOTAL	1	15	17	15	15	17	19	17	16
TOTAL (Ranking x Weight)		15	17	15	15	17	19	17	16

TABLE 6

HELENA/LEWIS & CLARK LANDFILL STUDY
RATING ANALYSIS SUMMARY

Weighting Category Summary	Area/Rating							
	A	B	C	D	E	F	G	H
5	140	140	140	145	155	135	100	100
4	52	56	56	56	60	64	52	52
3	81	90	90	78	75	87	57	69
2	54	46	50	48	50	42	46	46
1	15	17	15	15	17	19	17	16
Total	342	349	351	342	357	347	272	283
Place	5-6 (tie)	3	2	5-6 (tie)	1	4	8	7

PART FOUR

EVALUATION OF INTERMEDIATE PROCESSES

PART FOUR

EVALUATION OF INTERMEDIATE PROCESSES

I. GENERAL

The primary purpose of this Work Element was to identify and generally evaluate various intermediate processing or transportation systems in conjunction with the selection of a new landfill site. The primary purpose of considering these intermediate processing or transfer alternatives is to potentially reduce transportation and/or lower landfill operating cost. Since the waste collection and transportation practices for the City of Helena compared to the residents located outside the City are substantially different, a separate analysis was conducted for each entity. A separate analysis that addresses resource recovery of the waste in the area is also included at the conclusion of this chapter.

II. CITY OF HELENA ANALYSIS

A. Intermediate Processes

Currently there are numerous types of equipment being marketed which process solid waste prior to landfilling. Reasons for processing waste prior to landfilling usually are two-fold; either; 1) the topography, climatic conditions or distribution of population is such that it is not practical or economical to locate and/or utilize a sanitary landfill using conventional techniques, or 2) the waste's composition or physical conditions must be altered so that all constituents can be recovered and reused. For this section the concerns of item (1) will be addressed. Concerns of item (2) will be addressed later in this chapter.

Based on the consultant's experience, it was determined that two major types of intermediate processes warrant discussion for use within the study area; these are shredding and baling solid waste prior to disposal at a sanitary landfill. Included in the following narrative is a description of the applicability of these processes to the study area's needs.

1. Shredding

The primary purpose of shredding solid waste is to obtain a material with more uniform properties. Once shredded, the material is better suited for landfilling, baling or recycling. In conjunction with landfilling the primary purpose of shredding is three fold; 1) it provides a uniform material which will compact more easily with less possibilities of future settlement, 2) it reduces volumes and thus reduces transportation costs when large distances are incurred and 3) it reduces operational problems by minimizing rodents, flies, blowing litter and uncontrolled fires.

Prior to 1980 there were several shred-landfill operations in existence in the U.S. One such facility was located in Great Falls. A review of this facility in 1980 by the local officials indicated several negative concerns. Basically, it was determined that the Great Falls facility was not economical due to the high capital and annual operating costs. These costs substantially outweighed the benefits that the shredding facility provided. Due to these adverse deficiencies, the Great Falls facility was closed in 1980.

Based on the situation in Great Falls as well as similar results occurring throughout the nation, it is not recommended that the City of Helena pursue a shred-landfill operation at this time.

2. Baling

The primary purpose of baling solid waste is to considerably reduce the wastes volume. The reduction of the waste volume affords several advantages in the management of solid waste. In regard to the transportation of solid waste, baling can significantly reduce the number of trips and correspondingly the cost if large waste quantities and long distances are incurred. In regard to operating sanitary landfills in which wastes are baled initially, several advantages are obtained. These include; 1) elimination of loose blowing paper and rubbish, 2) better control of flies and rodents, 3) elimination of landfill compaction equipment, and 4) a decrease in operation and capital costs due to less cover material required and higher densities affording the conservation of land.

Several types of balers are utilized today throughout the nation. Some balers compress the waste to densities in excess of 1,500 lbs, per cubic yard and do not require any type of banding. Other types of balers compact waste to lower densities necessitating wire or twine ties. In the majority of instances baling facilities require an enclosed building for waste dumping, conveying and processing.

Based on the consultant's research and experience, it was determined that the operational advantages obtained from baling do not justify the high costs incurred from owning and operating the equipment. A modular size baling facility which would accommodate the wastes generated in Helena would be in excess of $2,000,000 depending upon the improvements deemed necessary. In addition to the facility's capital cost and the facility's operational costs, a sanitary landfill cost must also be added. In the Helena area it can be assumed that the total system cost of a baling system would be substantially higher then the costs of operating a conventional landfill.

B. Transfer Systems

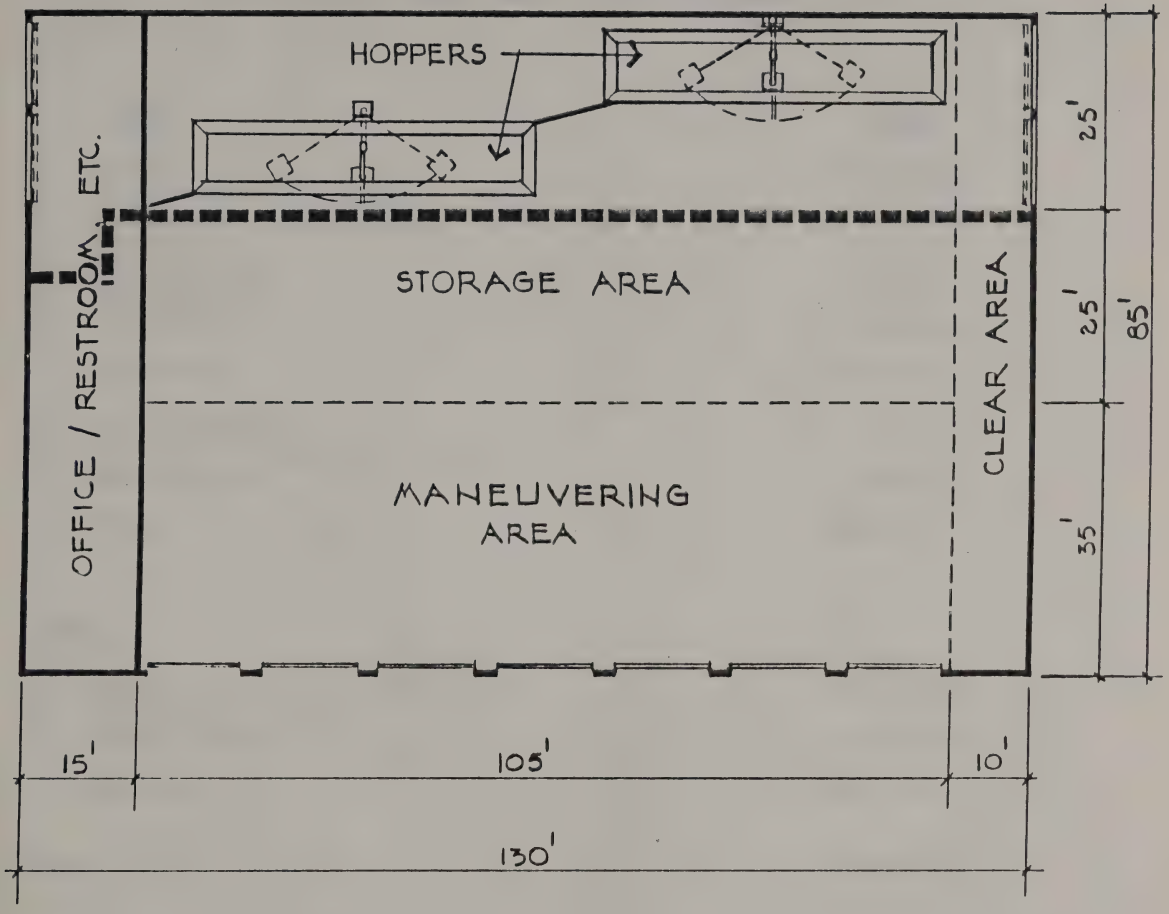
The primary purpose of utilizing a transfer station is to reduce the costs of hauling waste from the point of collection to the landfill site. If a transfer system is utilized, it is antici-

pated that all individuals as well as the large collection packer trucks would deposit their wastes at the transfer station. The wastes would correspondingly be loaded into large capacity trailers for transfer to the landfill site.

There are basically two types of systems that can be considered when evaluating the transfer station concept; 1) hauling the waste in a relatively "loose" condition in large transfer trailers or 2) hauling the waste in a "compacted" condition utilizing a hydraulically operated ram to compact the waste into large trailers. In accordance with the current technology, most municipalities in the nation are implementing the "loose" haul system. The "loose" haul system is in most cases more economical than the "compacted" haul systems due to the following reasons; 1) loose haul systems have substantially less facility capital and annual operating costs and 2) due to the weight limitations and new technology of trailer design, the loose haul system can actually haul more tons per load than the compacted systems. For these reasons the consultant evaluated the "loose" haul system for this analysis.

For this analysis it was assumed that all wastes that currently are being disposed of at the existing City of Helena landfill would be received and loaded into transfer trailers in a new enclosed transfer station facility. The facility would be located at the existing landfill site. The transfer trailers would be open top and loaded from the above tipping floor using a front-end loader. A mechanical arm would be used to consolidate the load and provide some compaction. The trailers would be approximately 50 feet long and have a payload of approximately 22 tons. The trailers would have a moving grate system in the floor that would allow the discharging of the load at the landfill site in approximately five minutes. A layout of the transfer facility is depicted on Figure 12. The capital cost to construct and equip the facility is estimated to be $992,000 (See Table 7).

In order to determine the economic feasibility of utilizing a transfer station, it is necessary to estimate the total cost of the transfer system and compare this with the cost for each individual car, pickup, truck and packer to travel to the landfill site. The costs for these two options are summarized herein:



HELENA TRANSFER STATION LAYOUT

Figure 12

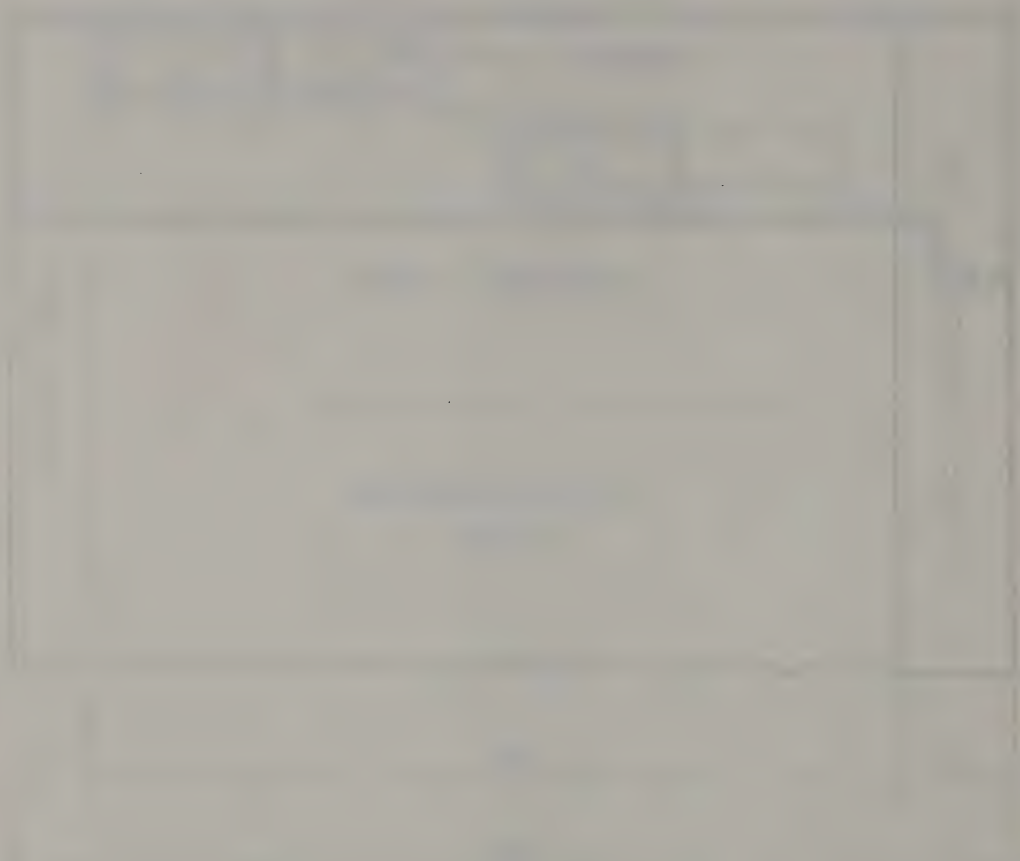


TABLE 7

CITY OF HELENA TRANSFER STATION
CAPITAL COSTS

	ITEM	TOTAL
1.	Land	$ 15,000
2.	Sitework & Utilities	100,000
3.	Building	210,000
4.	Concrete	300,000
5.	Finish Work	12,000
6.	Mechanical	20,000
7.	Electrical	20,000
	Subtotal	$677,000
8.	Contingency	67,000
9.	Interest During Construction	8,000
10.	Engineering	90,000
	TOTAL	$842,000

OTHER

1.	Front End Loader, etc (1)	$ 35,000
2.	Mechanical Arm (2)	70,000
3.	Extra Trailer (1)	45,000
	Subtotal	$150,000
TOTAL		$992,000

INDIVIDUAL HAUL TO LANDFILL
ANNUAL COST PER MILE

Item	(1) Units	(2) Unit Cost	Annual Cost Per Mile
Packer Truck	19,500 tons/yr	$.68/ton-mile	$13,260
Individuals	29,000 loads/yr	$.15/mile (each way)	8,700
Total			$21,960

(1) Based on 1986 City of Helena landfill records.
(2) Based on estimates determined by Damschen & Associates

TRANSFER ALTERNATIVE

A. FIXED COSTS

Item	Annual Cost
Transfer Station Operation	$75,000
Transfer Station Amortization of Equipment (5 yrs - 9%)	38,000
Transfer Station Amortization of Facility (20 yrs - 9%)	92,000
TOTAL ANNUAL FIXED COSTS	$205,000

Less Landfill Cost Savings Due To The Fact That Substantially Less Numbers Of Vehicles Would Travel To The Landfill Under This Option:

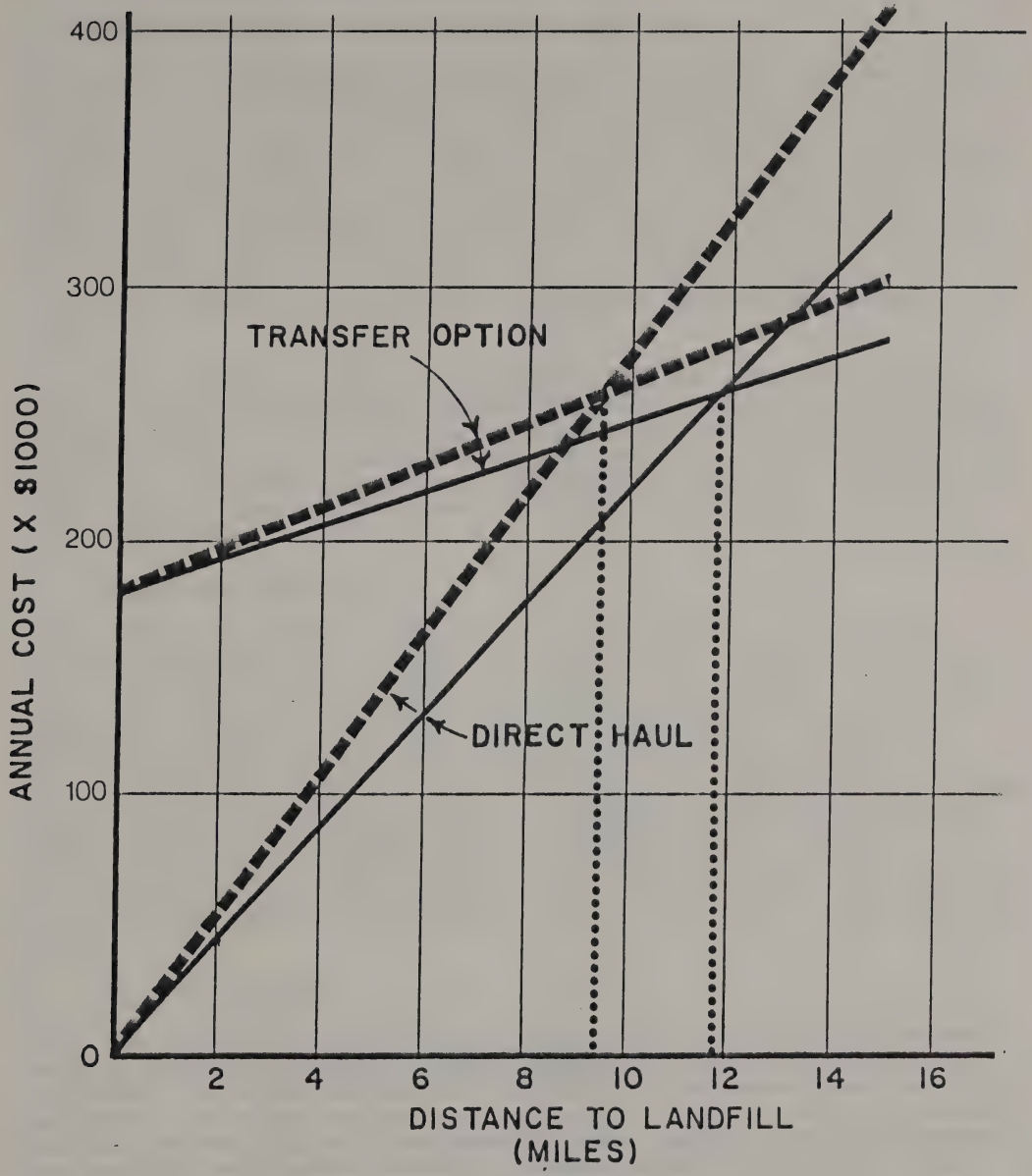
Insurance	$10,000
Litter Control	10,000
Road Maintenance	5,000
	$25,000
NET ANNUAL FIXED COSTS	$180,000

B. VARIABLE COSTS PER MILE PER YEAR

Transfer Trailers (30,000 tons/yr X $.22/ton-mile)	$ 6,600

Based on the information and assumptions developed on the previous page it can be seen that for each mile the landfill is located from Helena, the annual transportation costs for the direct haul alternative increase at the rate of $15,360 compared to the transfer alternative ($21,960 -$6,600). The transfer alternative, however, has Fixed Costs in the amount of $180,000 that also must be taken into account. The sensitivity of these factors for each alternative are graphically depicted on Figure 13.

As indicated on Figure 13, the break even distance at which a transfer station becomes economically feasible is approximately 11.5 miles. For comparison purposes the same analysis was conducted assuming a 25% increase in waste generation. This analysis indicates that the break even distance from Helena at which a transfer station would become economically feasible would be approximately 9.5 miles. A review of the location of the candidate landfill areas indicate that five of the eight areas (B, C, D, E and F) are equal to or greater than 9.5 miles from the City of Helena and thus would warrant a more detailed study of the feasibility of implementing a transfer system.



Current waste generation

25 % Increase

HELENA TRANSPORTATION ANALYSIS

Figure 13

III. SCRATCHGRAVEL LANDFILL DISTRICT ANALYSIS

In regard to evaluating possible transfer systems for the members of the Scratchgravel Landfill District, there are basically two options. Option 1 would include the closing of the existing landfill and replacing it with a transfer station similar to that evaluated for the City of Helena (obviously the facility would be smaller since there is only approximately 25% of the wastes generated in the District compared to the City of Helena's landfill). The second option would be to locate several container sites throughout the District. These containers would be serviced as necessary with the wastes hauled to the new landfill site.

Due to the large distances and relatively low population densities of the Scratchgravel Landfill District, the consultant recommends that a container program would more efficiently serve the Scratchgravel District residents compared to a single transfer station. Basically there are two types of container systems that are being utilized in Montana. A brief description of each is included herein:

1. Green Box System

This system basically consists of locating several small containers varying from 4 cubic yards to 8 cubic yards in size throughout the service area. Containers are placed in locations that are readily accessible, including intersections of local highways, recreational areas and in or near small communities. These container systems can be designed such that the waste in the containers can be emptied into either a front loading or rear loading waste collection vehicle. Currently seven counties in Montana are utilizing this type of system for the disposal of wastes in the less populated area. The majority of these counties utilize the front-loading collection vehicle arrangement due to its lower labor and operational costs compared to rear-loading systems,

2. Roll-Off System

This system in concept is quite similar to the Green Box system with the exception that a fewer number of larger containers are utilized. In most instances, the size of the containers utilized in this type of system are approximately 40 cubic yards although containers varying in size from 20 cubic yards to 50 cubic yards do function well under certain circumstances. Because of the large size of the containers, a ramp must be built at the container site. Under this system, a specially designed vehicle with a truck chassis and tilt-frame bed is utilized to load, unload and transfer the waste from the container site to the disposal site. Unlike the Green Box system where the container is emptied on-site, this system requires the tilt-frame vehicle to leave an empty container and pickup the full container. Currently several counties in the state are utilizing this system, including Cascade, Carbon, Yellowstone, Big Horn, Jefferson,

Broadwater, Madison and Valley counties.

Based on the consultant's experience in working with counties throughout the state, it is recommended that a Roll-Off system be considered in comparison to a Green Box system. The primary advantage of a Roll-Off system is the fact that the containers are large enough to accommodate all types of wastes including bulky materials, etc. Green Box systems can not effectively handle the larger size materials and ultimately the disposal of these large objects becomes burdensome and expensive.

To effectively manage the wastes generated within the Scratchgravel District, the consultant recommends that at least nine (9) container sites be constructed. As indicated on Table 8, the capital cost for these sites would be approximately $369,000 ($41,000 per site). As also indicated in Table 8, the net annual cost of the nine sites (after the estimated landfill cost savings due to the decreased traffic that would occur at the landfill site were subtracted) is estimated to be $35,000.

To compare the net cost of the Roll-Off container alternative with the option of each individual hauling their own waste to the landfill, the net transportation costs for each option were estimated. These costs are summarized herein:

INDIVIDUAL HAUL TO LANDFILL
ANNUAL COST PER MILE

Transportation Mode	(1) Units	(2) Unit Cost	Annual Cost/Mile
Packer Truck	3,000 Tons	$.68/Ton-mile	$ 2,040
Individuals	35,000 Loads	$.15/Mile (each way)	10,500
Total			$12,540

ROLLOFF TRANSFER ALTERNATIVE
TRANSPORTATION COSTS

Transportation Mode	(1) Units	(2) Unit Cost	Annual Cost/Mile
Packer Truck	3,000 Tons	$.65/Ton-mile	$2,040
Rolloff System	7,000 Tons	$.58/Ton-mile	4,060
Total			$6,100

(1) Based on data provided by Scratchgravel landfill supervisor
(2) Based on estimates determined by Damschen & Associates

TABLE 8

ROLLOFF CONTAINER SITES

CAPITAL COST

ITEM	TOTAL
Land	$ 2,000
Concrete	18,000
Earthwork	3,000
Fencing, etc	6,000
Gravel	1,000
Subtotal	$ 30,000
Engineering & Contingency	6,000
Subtotal	$ 36,000
Container Cost	5,000
TOTAL	$ 41,000

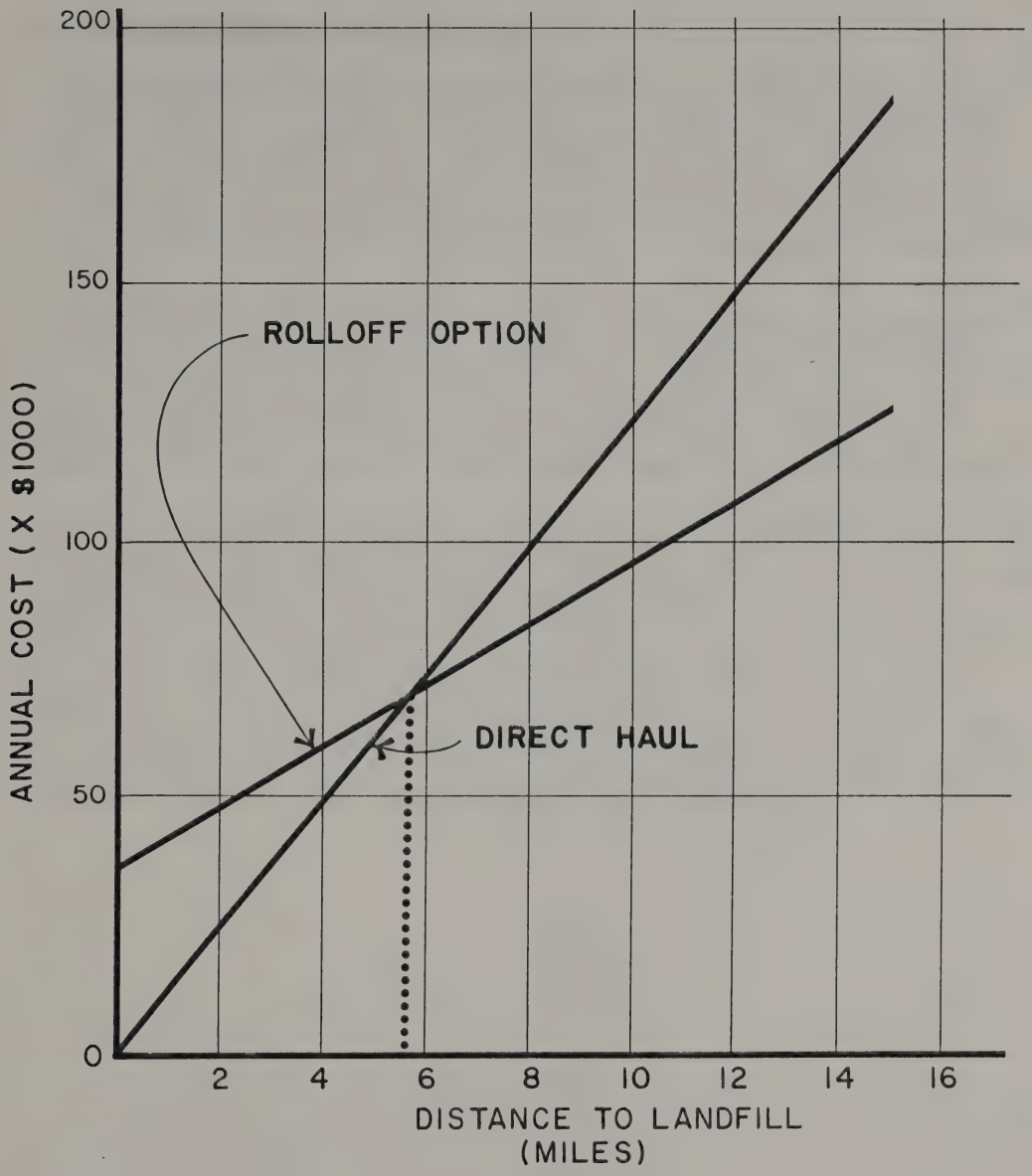
Sites At:
Scratch Gravel, Silver City, Lincoln Road & Montana, Causeways, Canyon Ferry, Canyon Ferry Road, Sierra Road, Unionville, Colorado Gulch

$41,000 X 9 Sites = $369,000

ANNUAL COST

ITEM	TOTAL
Amortization (20 years, 9%)	$ 41,000
Site Maintenance	9,000
Total	$ 50,000
LESS LANDFILL COST SAVINGS	
Traffic Control	$ 5,000
Insurance	2,000
Litter Control	3,000
Road Maintenance	5,000
Total	$ 15,000
NET ANNUAL FIXED COST	$ 35,000

In order to determine the economic feasibility of utilizing a rolloff container system, it is necessary to estimate the total cost of the transfer system and compare this cost with the cost for individual hauling. The sum of the fixed and transportation costs of the container systems are graphically represented and compared to the transportation costs for the individual hauling option on Figure 14. As indicated on the figure, the breakeven point of where the rolloff container option becomes cost effective is at 6 miles. If it is assumed that the existing Scratchgravel landfill site is the centroid of waste generation for the District, it becomes apparent that it would be feasible to implement a rolloff container system if any of the eight candidate landfill areas were selected with the exception of Area G.



Current waste generation

COUNTY TRANSPORTATION ANALYSIS

Figure 14

IV. RESOURCE RECOVERY ANALYSIS

As indicated in Part One of this report, the initial task of the study committee in 1985 and 1986 was to update the findings and conclusions of a Resource Recovery study that was conducted in 1981 for the Helena area. The conclusions of that update determined that resource recovery is not feasible at this time. Correspondingly, the study committee did not see the need to include a re-evaluation of this alternative in the consultant's scope of work.

During the six month period in which the consultant was selected and the study was initiated, however, the local officials discussed the possibility of implementing a Resource Recovery Facility with representatives of ASARCO, Inc. As a result of these conversations, the study committee added to the consultant's scope of services a work element whereby the consultant and ASARCO officials would further discuss and evaluate this option.

As the study progressed, the consultant provided ASARCO officials with data concerning the quantities of wastes and approximate landfilling transportation costs. Based on this information, the ASARCO officials evaluated the relative feasibility of their company constructing a resource recovery facility to handle the study area's solid waste. A formal decision by ASARCO was delivered to the consultant in a letter dated October 16, 1987. This letter basically concluded that it is not feasible for ASARCO to proceed with a resource recovery facility at this time. As indicated in the attached letter (see Appendix A), the primary reasons for this decision were due to economics, potential environmental impacts and socio-economic considerations.

PART FIVE

CONCLUSIONS

PART FIVE

CONCLUSIONS

I. SUMMARY OF PHASE ONE FINDINGS

A. Landfill Location Analysis

As indicated in Part Three of this analysis, eight candidate areas were evaluated during the course of this phase of the study. Correspondingly, a rating system was developed to rank each area. The analysis determined that the rating of six of the eight candidate areas were within four percentage points of each other. The ratings for the remaining two areas were significantly lower. A summary of the rating analyses is presented below:

Site	General Location	Rating Score
A	1-2 miles S.W. of East Helena	342
B	1-3 miles east of East Helena (south of U.S. 12)	349
C	2-4 miles east of East Helena (north of U.S. 12)	351
D	8 miles N.E. of Helena (near Canyon Ferry Road)	342
E	1 mile south of Causeway (near Lake Helena Drive)	357
F	North of Silver City	347
G	North of existing Scratchgravel Landfill	272
H	5 miles N.W. of Helena (north of Fort Harrison)	283

The final major task in Phase One of this landfill selection study was to eliminate three of the eight candidate areas. In order to accomplish this task a public meeting was conducted by the consultant and study committee to receive input. Approximately 100 residents and local officials attended the meeting and discussed their opinions and offered suggestions. In addition to this meeting, the consultant and study committee invited all prospective land owners that may be directly affected by the eight candidate areas to a special meeting to obtain their input. Also a public notice was published in the local newspaper indicating an address in which written comments pertaining to the

landfill location study could be sent.

Upon receipt of all comments, the consultant and study committee met on two separate occasions to discuss the findings and ultimately make a decision on which areas should be eliminated from further evaluation. Based on these meetings the committee ultimately voted to eliminate Areas D, G and H. Areas G and H were generally eliminated due to the low rating scores as well as the substantial public opposition that was expressed. Area D was eliminated primarily due to the impacts that would result from the increased traffic on Canyon Ferry Road and Hart Lane as well as the visual impacts that would result due to the proximity to local residential units and Canyon Ferry Road.

B. Transfer Station Analysis

As indicated in Part Four of this report, individual analyses were conducted to determine the feasibility of implementing transfer systems for the City of Helena and Scratchgravel Landfill District. The primary purpose for these analyses was to determine if it is more cost effective for cars, trucks and packer vehicles to individually drive to a new landfill site, compared to implementing transfer systems whereby the individual loads would be brought to a transfer facility(s) for consolidation into larger loads for hauling to a new landfill site.

The analysis for the City of Helena indicated that if a new landfill site is located in excess of approximately 9.5 miles from Helena, the City of Helena should consider implementing a transfer station system. This system would include the construction of an approximately $1,000,000 transfer station whereby all waste would be brought to the facility. The waste would correspondingly be loaded into semi-loads for transportation to the landfill site. Of the five candidate areas still under consideration, Area A is less then 9.5 miles, Area B and C are very close to the 9.5 mile range and Areas E and F are in excess of 9.5 miles.

In regard to the Scratchgravel Landfill District analysis, a rolloff container system was evaluated whereby nine - 40 cubic yard container sites would be strategically located throughout the District. The District members would then be able to dispose of their waste in the closest container site rather than hauling waste directly to a new landfill site. As the containers become full, a specially designed tilt-frame vehicle would transport the containers to the landfill site. The analysis conducted herein indicated that if the new landfill is located further than 6 miles from the waste generation centroid, the container system would be more cost effective than each individual hauling their own waste directly to the landfill. A review of the location of the selected candidate landfill areas indicates that all five areas are greater than six miles.

Upon review of this information and discussions with the study committee, it was determined that a more detailed analysis of the economics of implementing a transfer system for the City of Helena and the Scratchgravel District should be conducted during the second phase of this study. It was also decided that an analysis concerning the feasibility of using rail haul for candidate Areas B and F should be conducted since existing Burlington Northern Railroad tracks are located adjacent to these two areas. This analysis will be conducted in Phase Two of this study.

C. Resource Recovery Analysis

As indicated in Part Four of this report, ASARCO, Inc. representatives were approached during the first phase of this study to determine the potential feasibility of ASARCO constructing a resource recovery facility at their East Helena smelter. ASARCO officials responded with a letter dated October 16, 1987 that indicated that it is not feasible for their company to implement such a program at this time due to economic, environmental and social considerations. This response coincides with previous studies conducted for the City of Helena in 1979 and 1981 concerning the feasibility of resource recovery in the area as well as the update prepared by the Study Committee in 1986.

II. PHASE TWO SCOPE OF SERVICES

According to the Scope of Services in the consultant's agreement, the next step of the landfill selection process is to conduct a detailed analysis of the selected five (5) candidate areas. For this analysis, specific landfill sites will be selected from each candidate area. For these selected sites, analyses concerning the following criteria will be evaluated.

Environmental Conditions

* Geohydrology, hydrology, geology, earthquake faults and soils
* Drainage and topography
* Air
* Noise
* Vegetation and wildlife

Social Conditions

* Land use and ownership
* Transportation to the site
* Local and on-site access
* Traffic
* Proximity to occupied dwellings and projected future development
* Visual effects

Economics

* Availability and cost of land
* Site development costs
* Site operational costs
* Alternate transfer systems and costs
* Total system costs

Upon completion of these additional investigations and analyses for each site, a rating system will be developed. Correspondingly each site will be rated for comparison purposes.

At the conclusion of the site rating analysis the consultant will develop a strategy for the implementation of a new landfill site. The strategy will address:

* Alternatives for site ownership
* Alternatives for site acquisition
* Alternatives for operating the site
* Alternatives for financing capital and operating costs
* Development of an implementation schedule

During the Phase Two work it will be important to develop and maintain a public information and involvement program similar to the program conducted during the Phase One work. This program will be essential for reviewing interim findings of the analysis and obtaining public comment.

APPENDIX A

LETTER FROM ASARCO

ASARCO

EAST HELENA PLANT

October 16, 1987

Mr. Barry E. Damschen, P.E.
Damschen & Associates
Consulting Engineers
P. O. Box 4817
Helena, MT 59604

Dear Barry:

In late 1985, the City of Helena and the County of Lewis & Clark established a joint City/County Solid Waste Study Committee (CCSWSC) with the objective of investigating long range solutions to solid waste disposal for southern Lewis & Clark County. It is estimated that within five years, both City and County residents will experience a shortage of landfill capacity for disposing of solid waste.

Several alternatives for solid waste disposal have been proposed including resource recovery (waste to energy incineration), incineration (without energy recovery), and landfill. I understand from our recent discussions that Damschen & Associates have been charged with the responsibility of assessing these three alternatives (focusing primarily upon the alternate landfill option) and reporting their findings to the study committee. As part of your broad assessment in evaluating these prospective alternatives for solid waste disposal, you have requested that the Asarco East Helena Plant determine what involvement we might offer in disposing of the surrounding area's solid waste by incineration. This brief letter serves to notify you of Asarco's findings regarding this matter as we discussed at our meeting on October 9, 1987.

In arriving at our final determination, several preliminary evaluations were made based on our present Plant configuration and information previously provided by you. First, there is no facility in place at the East Helena Plant for incinerating the volume of solid waste being generated in the County. Therefore, an on-site incinerator, estimated at $5 Million, would need to be constructed. Asarco is not in a position for committing to such a large capital expenditure at this time.

ASARCO Incorporated, P.O. Box G, East Helena, MT 59635
(406) 227-7100, Telex 31-3120

SECOND, RESOURCE RECOVERY (WASTE TO ENERGY INCINERATION) WAS NOT CONSIDERED A VIABLE OPTION SINCE OUR FACILITY ALREADY GENERATES EXCESSIVE HEAT FROM OUR PYROMETALLURGICAL OPERATIONS AND HAS NO MEANS FOR DELIVERY OR CUSTOMER DEMAND. THIRD, SOLID WASTE INCINERATION WILL GENERATE A CERTAIN AMOUNT OF WASTE ASH WHICH CANNOT BE DISPOSED OF AT OUR FACILITY. THIS, COUPLED WITH THE FACT THAT DEMOLITION BULK AND WHITE GOODS ARE NOT ABLE TO BE INCINERATED, WILL REQUIRE THE COUNTY TO RELY UPON SOME TYPE OF ALTERNATE LANDFILL DISPOSAL. FOURTH, ASSUMING A CHARGE OF $15/TON TO $30/TON FOR INCINERATION OF SOLID WASTE, ASARCO COULD OPTIMISTICALLY ANTICIPATE A RETURN ON A CAPITAL INVESTMENT NEAR 25 YEARS.

IN SUMMATION, THESE FACTORS, ALONG WITH PROJECTED OPERATING COSTS, POTENTIAL ENVIRONMENTAL IMPACTS AND SOCIO-ECONOMIC CONSIDERATIONS, PRECLUDES ASARCO FROM ENTERTAINING THE PROSPECTS OF A SOLID WASTE INCINERATOR.

IF I CAN BE OF FURTHER ASSISTANCE IN EXPLAINING ASARCO'S POSITION PRIOR TO YOUR SCHEDULED MEETING NEXT WEEK, PLEASE FEEL FREE TO CONTACT ME.

SINCERELY,

JON C. NICKEL
INDUSTRIAL QUALITY MANAGER

JCN/CAR

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Helena, MT 59601

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